A/D Converter

FAD-30

Technical Manual

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1. SAFETY INSTRUCTIONS

CAUTION READ this manual BEFORE operating or servicing this equipment. FOLLOW these instructions carefully. SAVE this manual for future reference. DO NOT allow untrained personnel to operate, clean, inspect, maintain, service, or tamper with this equipment. ALWAYS DISCONNECT this equipment from the power source before cleaning or performing maintenance. CALL FLINTEC ENGINEERING for parts, information, and service.

WARNING ONLY PERMIT QUALIFIED PERSONNEL TO SERVICE THIS EQUIPMENT. EXERCISE CARE WHEN MAKING CHECKS, TESTS AND ADJUSTMENTS THAT MUST BE MADE WITH POWER ON. FAILING TO OBSERVE THESE PRECAUTIONS CAN RESULT IN BODILY HARM.

WARNING FOR CONTINUED PROTECTION AGAINST SHOCK HAZARD CONNECT TO PROPERLY GROUNDED OUTLET ONLY. DO NOT REMOVE THE GROUND PRONG.

WARNING DISCONNECT ALL POWER TO THIS UNIT BEFORE REMOVING THE FUSE OR SERVICING.

WARNING BEFORE CONNECTING/DISCONNECTING ANY INTERNAL ELECTRONIC COMPONENTS OR INTERCONNECTING WIRING BETWEEN ELECTRONIC EQUIPMENT ALWAYS REMOVE POWER AND WAIT AT LEAST THIRTY (30) SECONDS BEFORE ANY CONNECTIONS OR DISCONNECTIONS ARE MADE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN DAMAGE TO OR DESTRUCTION OF THE EQUIPMENT OR BODILY HARM.

CAUTION OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES.

2. DECLARATION OF CONFORMITY

FLINTEC

CE

EG-Konformitätserklärung
EC-Declaration of Conformity

Monat/Jahr: *month/year:*	05/2010
Hersteller: *Manufacturer:*	Flintec GmbH
Anschrift: *Address:*	Bemannsbruch 9 D-74909 Meckesheim Deutschland / Germany
Produktbezeichnung: *Product name:*	FAD-30 A/D Converter Series

Das bezeichnete Produkt stimmt mit folgenden Vorschriften der Europäischen Richtlinien überein:
This product confirms with the following regulations of the Directives of the European Community

Richtlinie 2004/108/EG des Europäischen Parlaments und des Rates vom 15. Dezember 2004 zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit und zur Aufhebung der Richtlinie 89/336/EWG	***Directive 2004/108/EC*** *of the European Parliament and of the Council of 15th December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC*
Richtlinie 2006/95/EG Niederspannungs-Richtlinie	***Directive 2006/95/EC*** *Low Voltage Directive*
Die Absicherung aller produktspezifischen Qualitätsmerkmale erfolgt auf Basis eines zertifizierten Qualitätsmanagement-Systems nach DIN ISO 9001.	*All product-related features are assured by a quality system in accordance with ISO 9001.*
Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, beinhaltet jedoch keine Zusicherung von Eigenschaften.	*This declaration certifies the conformity with the listed directives, but it is no promise of characteristics.*

Folgende Normen werden zum Nachweis der Übereinstimmung mit den Richtlinien eingehalten:
As a proof of conformity with the directives following standards are fulfilled:

EN 61326-1	Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen - Teil 1: Allgemeine Anforderungen (IEC 61326-1:2005) *Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements (IEC 61326-1:2005)*
EN 60950-1	Einrichtungen der Informationstechnik - Sicherheit - Teil 1: Allgemeine Anforderungen (IEC 60950-1:2005, modifiziert); *Information technology equipment - Safety - Part 1: General requirements (IEC 60950-1:2005 modified)*

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Technischer Leiter / *Technical Director*

3. INTRODUCTION

3.1. Overview

The type FAD-30 A/D Converter Series consists of powerful and economic state-of-the-art instruments for static and dynamic weighing applications plus force and torque measurements.
Each instrument of the series converts the analogue low level signal from a load cell or a strain gauge sensor to a digital high-resolution and high-accuracy signal and transmits the digital data to an external PLC or PC system. As a special feature the instruments can switch between unipolar and bipolar input range without affecting the external resolution.
The type FAD-30 A/D Converter Series comprises various instuments for different industrial bus systems:

FAD-30 A/D Converter with RS485 interface

FAD-30PB A/D Converter with Profibus DP interface

FAD-30EN A/D Converter with Ethernet TCP/IP interface

FAD-30MB A/D Converter with Modbus RTU interface

FAD-30PN A/D Converter with ProfiNet interface

FAD-30CO A/D Converter with CANopen interface

Figure 3.1 – FAD-30 A/D Converter series instruments

3.2. Key features and Specifications

Key Features	FAD-30	FAD-30MB	FAD-30PB	FAD-30PN	FAD-30EN	FAD-30CO
Bipolar signal input in Force and Count modes	Yes	Yes	Yes	Yes	Yes	Yes
500 to 100 000 counts external resolution at calibrated data	Yes	Yes	Yes	Yes	Yes	Yes
Unipolar 1 million and bipolar 2 million counts is adjusted and filtered to external resolution in count mode	Yes	Yes	Yes	Yes	Yes	Yes
High internal resolution up to 8 million counts	Yes	Yes	Yes	Yes	Yes	Yes
Up to 800 conversions per second	Yes	Yes	Yes	Yes	Yes	Yes
Standard Serial interface RS-232C	Yes	Yes	Yes	Yes	Yes	Yes
Standard Serial interface RS-485A	Yes	Yes	No	No	No	No
Modbus RTU interface	No	Yes	No	No	No	No
Profibus DP-V1 interface	No	No	Yes	No	No	No
ProfiNet interface	No	No	No	Yes	No	No
Ethernet (Modbus TCP/IP or BSI) interface	No	No	No	No	Yes	No
CANopen interface	No	No	No	No	No	Yes
Continuous data output	Yes	Yes	No	No	No	No
BSI data interface	Yes	Yes	No	No	No	No
Bus address selection by setup switch (from 0 to 7)	Yes	Yes	Yes	No	No	Yes
Setup by Flintec xFace PC software	Yes	Yes	Yes	Yes	Yes	Yes
Auto-zero tracking and auto-zero at power-up	Yes	Yes	Yes	Yes	Yes	Yes
Motion detection	Yes	Yes	Yes	Yes	Yes	Yes
Zeroing and Taring by bus commands	Yes	Yes	Yes	Yes	Yes	Yes
Adaptive digital filter for fast and stable reading	Yes	Yes	Yes	Yes	Yes	Yes
Up to 6 load cells (350 Ω) or 18 load cells (1100 Ω)	Yes	Yes	Yes	Yes	Yes	Yes
Electronic calibration (eCal) without test weights	Yes	Yes	Yes	Yes	Yes	Yes
Zero and Span calibrations over bus interface	Yes	Yes	Yes	Yes	Yes	Yes
Zero adjustment	Yes	Yes	Yes	Yes	Yes	Yes
Span adjustment with test weights	Yes	Yes	Yes	Yes	Yes	Yes
Span adjustment with temporary zeroing for unloaded tanks	Yes	Yes	Yes	Yes	Yes	Yes
Power-on testing with setup switch	Yes	Yes	Yes	Yes	Yes	Yes
24 V DC power supply (11 to 28 V DC input voltage range)	Yes	Yes	Yes	Yes	Yes	Yes

Specifications

A/D Converter:	
A/D converter type:	24 bit Delta-Sigma radiometric with integral analog and digital filters
Analog input range:	0 mV to +18 mV (unipolar) ; - 18 mV to +18 mV (bipolar)
Linearity:	< 0.0015 % FS
Temperature coefficient:	< 2 ppm/°C
Min. input per vsi	0.1 µV/d (non approved)
Conversion rate:	Up to 800 measurement values per second
Internal resolution:	Up to 8 million counts
External resolution	Up to 100 000 counts (weight value, force, torque) respective 1 million raw counts (unipolar) respective 2 million counts (bipolar)
Calibration and Weighing Functions:	
Calibration:	Electronic calibration without test weights (eCal) or calibration by test weights
Digital filter:	10 step programmable adaptive filter
Weighing functions:	Tare, zero, auto zero tracking, motion detection, auto-zero at power-up, save tare at power-off, increased resolution
Load cells:	
Excitation:	5 V DC at 58...1200 Ω, max. 100 mA
Number of load cells:	Up to 6 load cells à 350 Ω or 18 load cells à 1100 Ω in parallel
Connection:	4- or 6-wire technique, cable length 250 m/mm² for 6-wire connection

Communication and Setup:	
Serial interface RS-232C:	9600 baud (8,N,1)
Other interfaces	Depends on instrument type
Response time	< 4 ms (delay after each read or write command)
Setup and calibration	By PC software via RS232C, backup data stored on PC
Power supply:	
DC power supply	10 to 28 VDC, < 200 mA, not galvanically isolated
Environment and Enclosure:	
Operation temperature:	Between -10 °C and +40 °C at maximum 85% RH max, non-condensing
Enclosure and protection	Polyamide, for DIN-rail mounting, IP20

Instrument with RS485 interface: Type FAD-30	
Communication:	
Serial interface RS485	1200 to 57600 baud (8N1, 7E1, 7O1), bus capability up to 31 units
Communication mode	Continuous or requested
Dimensions & weight	99 x 22.5 x 114.5 mm (L x W x H), weighs approx. 110 g

Instrument with Modbus RTU interface: Type FAD-30MB	
Communication:	
Serial interface RS485	1200 to 57600 baud (8N1, 7E1, 7O1), bus capability up to 31 units
Communication mode	Continuous or requested or Modbus RTU
Address range	1...31
Dimensions & weight	99 x 22.5 x 114.5 mm (L x W x H), weighs approx. 110 g

Instrument with Profibus DP interface: Type FAD-30PB	
Communication:	
Profibus DP-V0 + DP-V1	9,6 kbit/s to 12 Mbit/s (automatic), galvanically isolated interface
Address range	1...126
Dimensions & weight	99 x 45 x 114.5 mm (L x W x H), weighs approx. 150 g

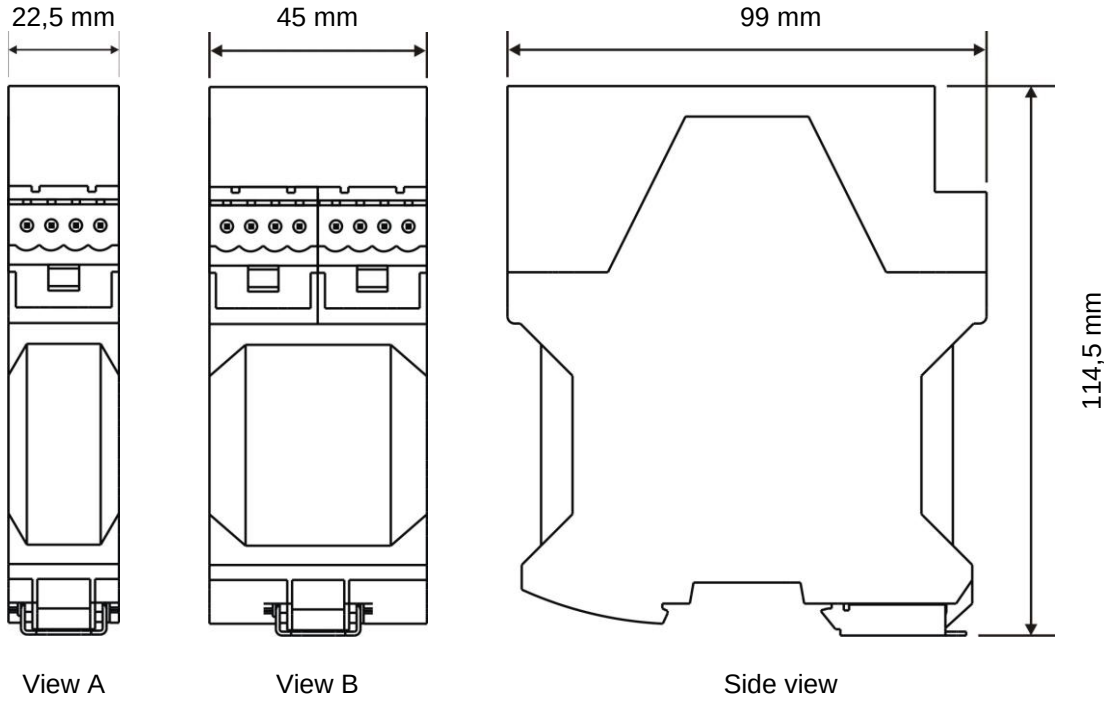
Instrument with ProfiNet interface: Type FAD-30PN	
Communication:	
ProfiNet	100 Mbit/s (full duplex), galvanically isolated interface
IP settings	DHCP or manual setup by PC software
Dimensions & weight	99 x 45 x 114.5 mm (L x W x H), weighs approx. 150 g

Instrument with Ethernet TCP/IP interface: Type FAD-30EN	
Communication:	
Ethernet TCP/IP	10 Mbit/s (half duplex), galvanically isolated interface
IP settings	Manual setup by PC software
Dimensions & weight	99 x 45 x 114.5 mm (L x W x H), weighs approx. 150 g
Other	Web client interface

Instrument with CANopen interface: Type FAD-30CO	
Communication:	
CANopen V.2.0	10 kbit/s...1 Mbit/s (automatic), galvanically isolated interface
Address range	1...126
Dimensions & weight	99 x 45 x 114.5 mm (L x W x H), weighs approx. 150 g

3.3. Housing

FAD-30 instruments come within a polyamide housing sealed to IP20. They are prepared for mounting on NS 37/7 or NS 35/15 standard DIN rails (see drawings).



View A: FAD-30, FAD-30MB
View B: FAD-30PB, FAD-30PN, FAD-30EN, FAD-30CO

Figure 3.2 – Dimensions

3.4. Accessories

Accessories supplied with the instrument

The following accessories are supplied together with the instrument. If any part is missing, please contact your supplier.

	FAD-30	FAD-30MB	FAD-30EN	FAD-30PB	FAD-30PN	FAD-30CO
4-pin and 5 mm pitch plug, light gray	1	1	2	2	2	2
7-pin and 3.81 mm pitch plug for load cell cable, black	1	1	1	1	1	1
6-pin and 3.81 mm pitch plug for RS-232C and RS-485, black	1	1				
Installation CD (xFace software, technical documentation)	1	1	1	1	1	1

Table 3.1 – Accessories supplied with instrument

Accessories sold separately

The following accessories are available from Flintec.

	FAD-30	FAD-30MB	FAD-30EN	FAD-30PB	FAD-30PN	FAD-30CO
RS-232C cable (3 m long) for connection with PC	√	√	√	√	√	√
Junction box for load cell connection	Refer to Flintec catalog					
Open end load cell cable, 6 wire (0.22 cm^2 each)	Max. 200 meter length					

Table 3.2 – Accessories supplied separately

4. INSTALLATION

PRECAUTION: Please read this manual carefully before you install the instrument. If you apply all recommendations in this chapter you will increase the reliability and long term performance of your system.

4.1. Recommendations

4.1.1. Control Cabinet Design

Warning: Please follow the following warnings for designing the control cabinet which will increase the reliability of your system.
The control cabinet should be designed therefor the A/D converters can operate safely. The panel should be placed in a clean area, without getting direct sun light if possible, with a temperature between -10 ºC and +40 ºC, humidity not exceeding 85% non-condensing. All external cables should be installed safely to avoid mechanical damages.
FAD-30 instruments are very low level signal measuring instruments. To avoid electrical noise, the instruments should be separated from equipment that produces electrical noise. Preferably use a metal cabinet against radio frequency interference, to protect against electromagnetic disturbance the cabinet shall be connected to ground. Keep the load cell cable trays separated from others, if possible. If there is noise-generating equipment such as heavy load switches, motor control equipment, inductive loads etc., please be careful against the EMC interference in the cabinet. If possible protect FAD-30 instruments by a Faraday cage or install them in a separate section or install them far a way from this kind of equipment. Install parallel reverse diodes to the DC inductive loads like relays, solenoids etc. to minimize voltage peaks on the DC power lines.

4.1.2. Cabling

All cables coming to the control cabinet shall be shielded. Please use separate cable trays for these low signal level cables. Distance from load cell cables, interface cables and DC power supply cables to power line cables shall be 50 cm at minimum.

4.1.3. Mechanical Installation

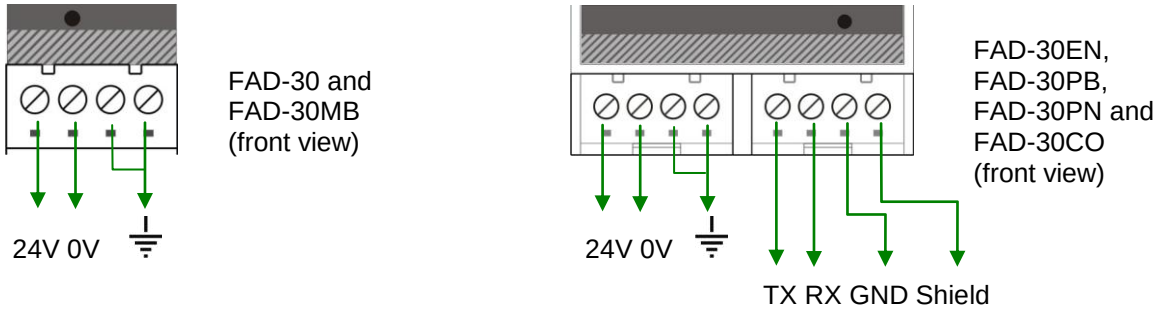
After designing the control panel and installing DIN rails according to the recommendation in this chapter, place the FAD-30 instruments on the DIN rail Be sure that the mechanical installation of the instruments is done properly.

4.2. Electrical Connections

Warning: Please always remember that FAD-30 instruments are very low voltage measuring instruments. Your control cabinet design and proper installation increases the reliability and the performance of the instrument. Please do not forget that the instrument must be powered off before inserting or removing any peripheral connector. All required electrical connections should be done as described below.

4.2.1. Power Supply and Grounding

The power supply voltage of the instrument shall be between 12 V DC and 28 V DC. The current consumption of the power supply will be calculated by multiplying 0.2 A and the quantity of instruments. The pin configuration of the 24 V DC power supply connector located at the bottom front of the instrument is shown below in figure 4.1.



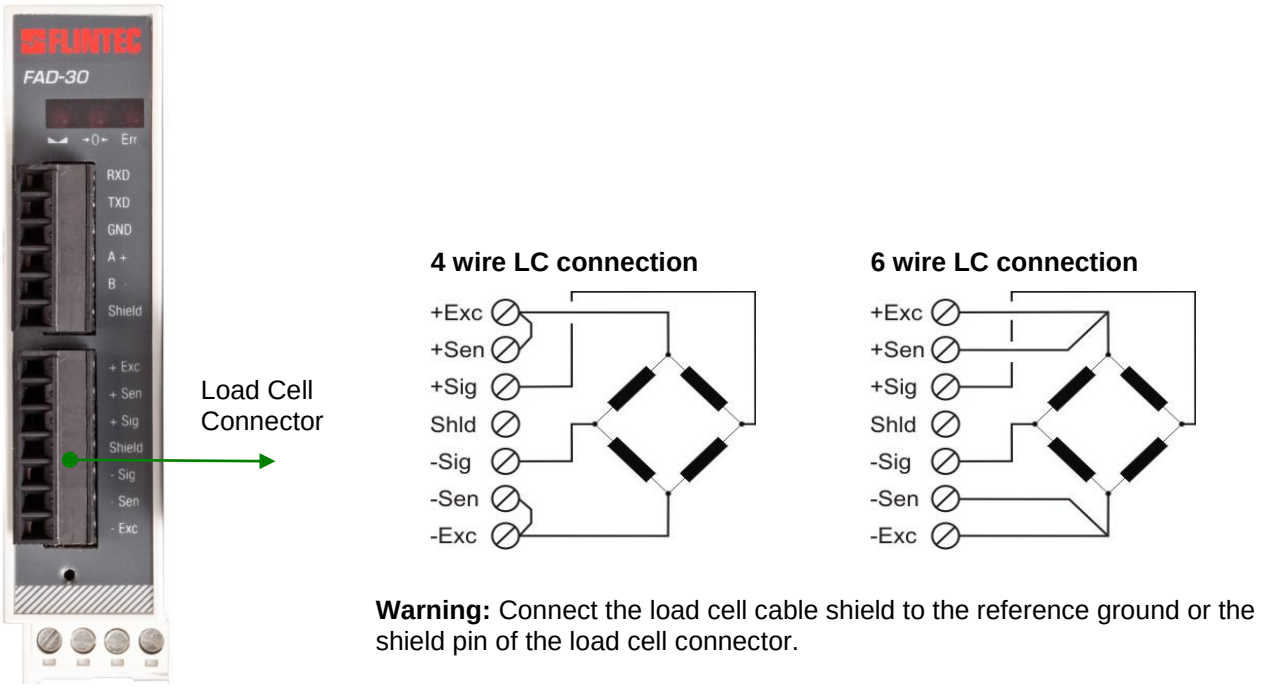
Warning: Do not forget to connect the Shield pin to the reference ground.

Figure 4.1 – The pin layout of 24 V DC connector

The quality of the instrument's ground will determine the accuracy and the safety of your measuring system. A proper ground connection is needed to minimize extraneous electrical noise effects on the measurement. A poor ground can result in an unsafe and unstable operation. It is important that the instrument should not share power lines with noise-generating equipment such as heavy load switching, motor control equipments, inductive loads, etc. If the condition of the power line in the plant is poor, prepare a special power line and grounding. Before interfering the instrument, turn off the power and wait at least for 30 seconds.

4.2.2. Load Cell Connection

To avoid damages, the load cell wiring should be made carefully before energizing the instrument. Load cell connection details are shown below in figure 4.2. In 4-wire installations the sense and excitation pins with the same polarity should be short circuited at the connector side. If you have a junction box in your system, use a 6 wire cable between FAD-30 and the junction box, and short circuit these pins at junction box for better performance.



Warning: Connect the load cell cable shield to the reference ground or the shield pin of the load cell connector.

Figure 4.2 – Load cell connection

4.2.3. Communication Interface

Please refer to the corresponding chapter:

FAD-30 (RS485)	see chapter 6.2
FAD-30MB (Modbus RTU)	see chapter 6.2
FAD-30PB (Profibus)	see chapter 7.2
FAD-30PN (ProfiNet)	see chapter 8.2
FAD-30EN (Ethernet and Modbus TCP)	see chapter 9.2
FAD-30CO (CANopen)	see chapter 10.2

4.3. Commissioning

PRECAUTION: Please read this manual carefully before energizing the instrument. Perform the commissioning operation according the procedure given in this chapter. Only trained persons are allowed for cleaning, commissioning, checking and servicing of the instrument. The interference of untrained person may cause some unwanted damages or injuries.
Before energizing the instrument, please make the required mechanical and electrical installations. After power on, you have to setup your FAD-30 instrument before you can start to use the bus interface.
Install the xFace software onto your PC as described in chapter 5 Setup. The xFace software is used for setup, calibration and testing of FAD-30xx instruments.
After you have successfully checked the performance of the instrument with xFace, you can begin to use the instrument in your application.

5. SETUP

PRECAUTION: Please read this manual carefully before energizing the instrument. Perform the commissioning according the procedure given in chapter 4.3. Only trained person are allowed for commissioning, checking, cleaning and servicing of the instrument. The interference of untrained person may cause some unwanted damages or injures.

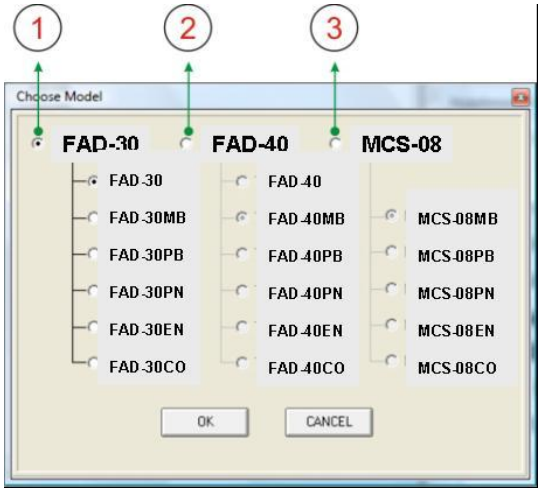
FAD-30 series instruments are setup and calibrated by the xFace software supplied with the instrument. The instruments shall be setup in the sequence described below before you can use the bus interface.

- Install the xFace software onto your PC
- Connect your PC with the instrument over the serial interface (RS232 respective RS485)
- Setup and calibrate the instrument
- Check the performance of the instrument

5.1. Installation of the xFace Software

Please follow following steps to install the xFace software:

- Close all applications on your PC
- Insert the CD that contains the xFace software into the CD-ROM drive
- Double click “Setup.exe” to start the installation. The setup Wizard is displayed.
- Follow the menus in the setup wizard step by step.
- After finishing the installation, the Setup Wizard will inform you about the success of the software installation. Click the OK button.
- After closing the Setup Wizard you can start to use the xFace software.



1 Typ FAD-30: Select one of the FAD-30 models and press OK button.

2 Typ FAD-40

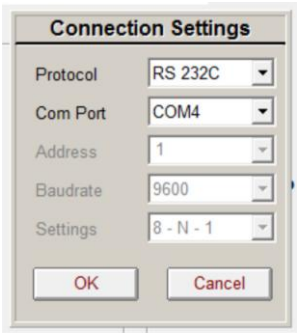
3 Typ MCS-08

Figure 5.1 – xFace type selector window

5.2. Connection to the xFace Software

The connection between FAD-30 and the xFace software is done via the RS-232C service port for all models. Alternatively Ethernet (for FAD-30EN only) and RS-485 (for FAD-30MB only) can be used for this connection. You can purchase a suitable PC connection cable as an accessory from Flintec (Refer to chapter 3.4.2).

After running the xFace software select the FAD-30 model you use (see figure 5.1.). Select the PC’s communication port within the Connection settings menu in the tools tab (see figure 5.2) and click the connect icon. After the communication between FAD-30 and your PC has successfully started the traffic light of the connect icon turns from red to green.



Protocol: Select the setup port of the instrument. FAD-30 and FAD-30MB instruments can be setup over RS-232 or RS-485. Other models can be setup over RS-232C.

Com Port: Select the communication port of the PC

Address: Select the RS-485 address, if RS-485 is selected

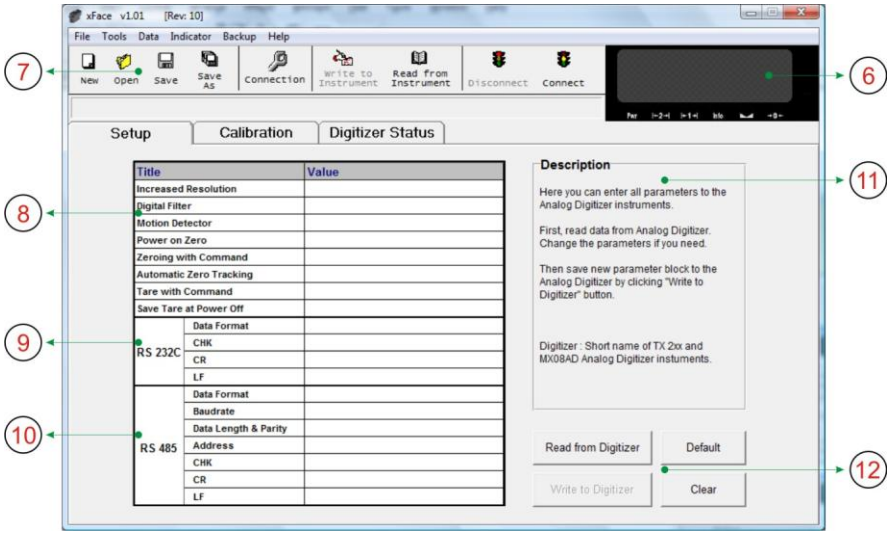
Baud rate: Select the RS-485 baud rate, if RS-485 is selected

Setting: Select the RS-485 communication port setting, if RS-485 is selected

Figure 5.2 – xFace Connection Settings

5.3. A/D Converter Setup and Calibration

WARNING: Read this manual carefully before you setup and calibrate the instrument. This will increase the performance of your weighing system by applying proper setup and calibration.



6	**Visual Weight Display:** Displays the weight, count or force value
7	**Toolbox:** Contains shortcuts of some special commands
8	**A/D Converter Parameters:** This block allows the user to setup the A/D Converter's parameter related to the operation mode. Refer to chapter 5.3.1
9	**RS-232C:** RS-232C serial port communication settings (not for FAD-30 and FAD-30MB)
10	**RS-485:** RS-485 port communication settings. (FAD-30 and FAD-30MB only)
11	**Description:** This block provides some clear-text explanations
12	**Read from A/D Converter:** Click this button to read the parameter settings from the instrument
	Write to A/D Converter: Click this button to save the parameter settings to the instrument
	Default: Click this button to load the factory default settings
	Clear: Empties the parameter settings

Figure 5.3 – FAD-30 Setup Parameters

For entering the parameter values enter the setup tab, adjust the parameter settings and then write this data to the A/D Converter. After changing parameter settings the instrument always requires a re-calibration.

5.3.1. Scale Parameters

In the setup menu the scale parameters of FAD-30 can be viewed, changed or saved to the instrument. These parameter settings are:

Increased External Resolution

For service purposes this parameter enables the 10 times higher resolution of the weight value than the defined interval in weighing and force mode. Increased resolution must be disabled for use in normal operation (Not available in Count Mode). Default setting: 'Disable'.

Digital Filter

Environmental noise like bounding forces, air flow, vibration, motor control instruments etc. may disturb the load cell signal. The selection of proper filter settings determines how quickly the system will react to the load cell signal.**Load cell signal digital filtering is done according to this parameter settings. The settings can be changed from 0 (fastest settling) to 9 (slowest settling). Default setting: '7'.

Setting	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Values/s	1600	800	400	200	100	100	100	50	50	50
Settling time [ms]	80	140	250	180	300	420	380	620	720	1800

Motion Detection

This parameter defines the motion detection window which determines a stable weighing. If motion detection is not required, this parameter can be disabled. The available motion detection window values are:

Weighing and Force Mode:

Disable	± 0.3e	± 0.5e (default setting)	± 1e	± 2e

Count Mode:

Disable	± 60	± 100 (default setting)	± 200	± 400

Power On Zero

This parameter enables automatic zeroing after powering on the instrument. The automatic zeroing is only done if the total zero drift from the calibrated zero signal is in the defined zeroing window. This zeroing window will be defined in the percentage of the scale capacity.

Disable (default setting)	± 2%	± 10%

To avoid unwanted zeroing at power on this parameter should be disabled or carefully set up in applications like silo weighing, tank weighing and automatic weighing applications. If the weight is not within the power on zeroing range, the instrument is powered on without zeroing (Not available in Count Mode).

Zeroing Range

Zeroing of the scale is performed if the difference between load cell signal value and unloaded load cell signal value at the calibration is in the selected percentage of the scale capacity. Zeroing can be done by zeroing command when the scale is stable. Zeroing can be done by zeroing command when the scale is stable.
The available zeroing ranges in the percentage of the scale capacity are:

Disable	± 2% (default setting)	± 20%	± 40%

Auto Zero Tracking

AZT automatically re-adjusts the scale to zero for compensating defined small deviations around the center of zero. AZT only works within the defined zeroing range and stops working if this range is left.To avoid unwanted zeroing this parameter should be disabled or carefully set up in applications like silo weighing, tank weighing and automatic weighing applications (Not available in Count Mode). The available AZT window values are;

Disable (default setting)	± 0,5e	± 1e	± 3e

Tare

If this function is enabled, the weight is tared when the tare command is received. Additional conditions for taring are positive gross weight and no motion. Multi-taring is possible with FAD-30 series (Not available in Count Mode). Default setting: ‘Enable’.

Save Tare at Power Off

If this function is enabled, the tare value is stored at power off and the instrument starts up in Net mode at power on (Not available in Count Mode). Default setting: ‘Enable’.

5.3.2. Serial Interface Setup

Data Format

This parameter defines the serial communication port data format for RS232 respective RS485. The available data formats are:

Disable:	Port will be disabled. Select “Disable” if this port is not used.
Continuous	The data is transmitted continuously (for FAD-30 and FAD-30MB only). Refer to chapter 5.8 for details.
BSI (default setting for FAD30)):	Communicates in BSI data format as a slave. Refer to chapter 5.9 for details.
Modbus RTU (default setting for FAD-30MB)):	Modbus RTU communication (for FAD-30MB only). Refer to chapter 5.11 for details

Note: xFace automatically connects to the instrument whatever the data format is. After xFace is disconnected, the instrument returns to operate with the last saved data format.
Warning: Disable this interface if it is not used to increase the interfacing performance.

Checksum
The checksum can be enabled or disabled within BSI and Continuous output data format. The checksum calculation can be found in the related data format description. Default setting: ‘Enable’.

Carriage Return
Carriage Return can be enabled or disabled within Continuous output data format. Default setting: ‘Enable’.

Line Feed
Line Feed can be enabled or disabled within Continuous output data format. Default setting: ‘Enable’.

The RS-485 setup is done by the xFace software as described in this chapter. Select the Setup tab after xFace has established a connection with your instrument. The Setup tab (see figure 5.3) includes all RS-485 settings.

Baud Rate (for RS485 only)
One of the following baudrate will be selected for the RS-485 communication port.

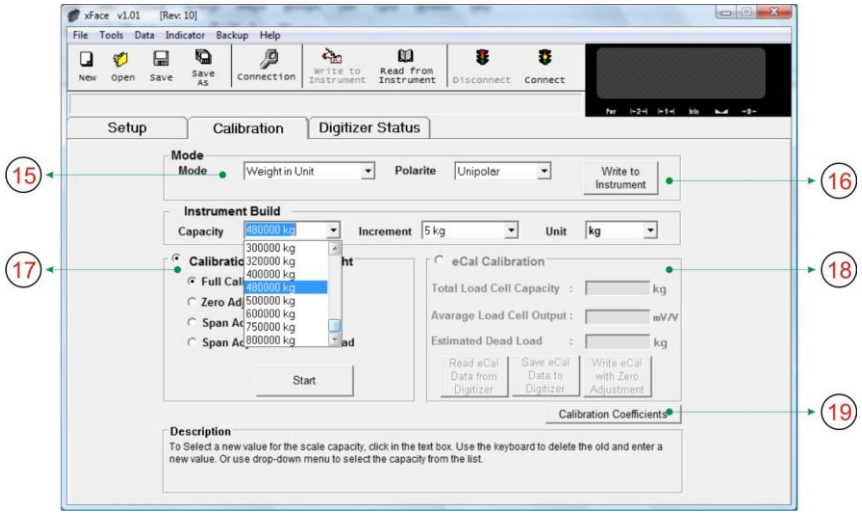
1200	2400	4800	9600 (default setting)
19200	38400	57600	

Data Length and Parity (for RS485 only)
The data length and parity can be selected as 8 None 1 (default), 7 Odd 1 or 7 Even 1.

Address (for RS485 only)
The address range is 01 (default) to 31. If you enter 0, the instrument will operate without address data.

Modbus RTU Setup (for FAD-30MB only)
RS-485 Data Format: ‘Modbus RTU’,
RS-485 Data Length & Parity: ‘8 none 1’,
RS-485 Address: ‘01’ to ‘31’

5.3.3. Scale Build and Calibration
Scale build, operation mode selection and scale calibration is performed in the calibration tab of xFace as shown in figure 5.4. Please follow the procedure in the sequence as described in the following chapters.



15	**Mode:** Here the user selects the operation mode and the polarity.
16	**Write to A/D Converter:** Click this button to save the operation mode and polarity to A/D Converter.
17	**Calibration block:** This block allows the user to calibrate with test weights.
18	**eCal Calibration:** This block allows the user to calibrate without test weights.
19	**Calibration Coefficients:** This function allows the user to restore a calibration if the calibration coefficients have been noted before.

Figure 5.4 – Calibration

Mode selection

FAD-30 instruments have three operation modes which are:

Count Mode:	Filtered and normalized ADC count data will be transmitted in this mode. The calibration is performed at the PLC, if any.
Weighing Mode:	Unipolar weight data in calibrated weighing unit will be transmitted. This mode is compatible to OIML R76 and EN 45501.
Force Mode:	Bipolar or unipolar force measurement data in calibrated force unit will be transmitted.

Select the scale operation mode and the polarity. Then click the “Write to A/D Converter” button to save your mode selection. The default calibration of FAD-30 instruments is Count Mode and 10 mV unipolar input signal range. If you select the Count Mode, there is no scale build and instrument calibration. Each FAD-30 instrument is adjusted for high accuracy during the production. The FAD-30 input signal ranges and their external resolutions are shown in Table 5.1.

Input signal range	Input Signal level	Polarity	External resolution
0 to 5 mV	5 mV	Unipolar	1 million counts
-5 to 5 mV		Bipolar	2 million counts
0 to 10 mV	10 mV	Unipolar	1 million counts
-10 to 10 mV		Bipolar	2 million counts
0 to 15 mV	15 mV	Unipolar	1 million counts
-15 to 15 mV		Bipolar	2 million counts
0 to 18 mV	18 mV	Unipolar	1 million counts
-18 to 18 mV		Bipolar	2 million counts

Table 5.1 - Count Mode, Input Signal Ranges and External Resolution

Select the input signal level and polarity for high external resolution. Write your mode selection to the instrument by clicking “Write to A/D Converter” button. Jump to the chapter 5.4.

Scale Build

The scale capacity, the increment and the unit have to be introduced to the FAD-30 instrument before you can perform a calibration in Weighing or Force mode.

Capacity:	To select a new value for the scale capacity, click in the text box. Use the keyboard to enter a new value, or use the drop-down menu.
Increment:	Use the drop-down menu to select the increment.
Unit:	Select the unit

The scale calibration can be performed by using test weights or by electronic calibration (eCal).

Calibration by Test Weights

This calibration method performs zero and span calibrations using test weights. For accurate calibration the test weight value should not be less than 1/10 of the scale capacity.

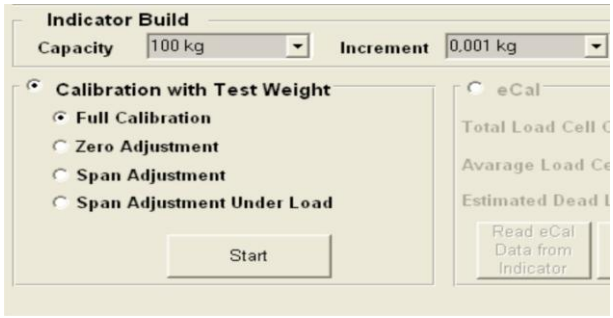


Figure 5.5 – Calibration by test weights

Please note that the scale build values should be entered before you start the calibration.
Select “Full Calibration” for performing a complete scale calibration. Click the “Start” button. Unload the scale for performing the zero calibration and click the “Yes” button. The virtual display will show the [WAIT] message during the zero calibration. During the zero calibration the scale must be stable. Approximately 5 seconds later the span calibration window will be displayed. Load the scale and enter the loaded test weight value, then click the “OK” button. The scale must be stable during the span calibration. Approximately 5 seconds later the new calibration settings are saved automatically.
If any error occurs during the calibration an error message warns you. Click the “Yes” button to reload the previous values or click the “No” button to use the new settings.
You can adjust the zero or the span of your scale without performing a full calibration. Additionally the “span calibration to the unloaded scale” feature is another tool of FAD-30 instruments for after-sale services.

Zero Adjustment

If your scale has a residual zero drift you may perform a zero adjustment only. Select “Zero Adjustment” and press the “Start” button. Then the zero calibration window will be displayed. Unload the scale and click the “OK” button. The [WAIT] message appears on the virtual display during the zero adjustment. Approximately 5 seconds later the zero adjustment will be finalized.
Note**:** Zero adjustment is also performed over the bus interface. Refer to the data structure of the related bus interface.

Span Adjustment

If your scale has a span drift, you may perform a span adjustment only. After selecting “Span Adjustment” and pressing the “Start” button, enter the test weight value; place the test weights on the scale and press the “Yes” button. The [WAIT] message appears on the virtual display approximately for 5 seconds while the span calibration is being performed. After finalizing the span adjustment, the instrument will save the span coefficients automatically.
Note**:** Span adjustment is also performed over the bus interface. Refer to data structure of the related bus interface.

Span Adjustment under Load

This feature is being used to perform a span adjustment without unloading the scale. This operation is especially used for the span adjustment for non-empty tanks to make a span adjustment without emptying the tank. After selecting “Span Adjustment under Load” press the “Start” button. The temporary zeroing message appears on the monitor. This means the instrument will determine the existing load as the temporary zero. If the scale is stable press the “Yes” button. The [WAIT] message appears on the virtual display approximately for 5 seconds to determine the temporary zero. Then the span calibration window will be displayed. Load the scale and enter the loaded test weight value, then click the “OK” button. The scale must be stable in this period. Approximately 5 seconds later, the new calibration settings are saved automatically.
Please refer to the chapter 5.4 A/D Converter Performance Test).

Electronic Calibration (eCal)

eCal allows to perform a calibration without using test weights. FAD-30 is adjusted during production for increased eCal accuracy. The calibration will be done based on the scale capacity, the total load cell capacity, the load cell output and the estimated dead load. If the conditions are convenient for zero calibration, you may perform automatic zero adjustment instead of entering an estimated dead load.

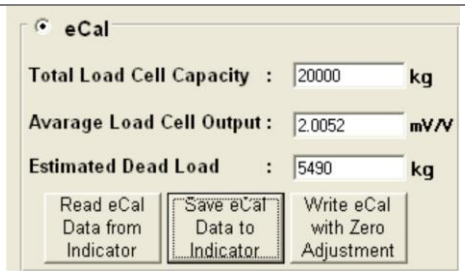

eCal
Total Load Cell Capacity : 20000 kg
Avarage Load Cell Output : 2.0052 mV/V
Estimated Dead Load : 5490 kg
Read eCal Data from Indicator
Save eCal Data to Indicator
Write eCal with Zero Adjustment

Figure 5.6 – eCal Calibration

After selecting eCal calibration enter the following values as:

Total Load Cell Capacity: Enter the total load cell capacity in kg as shown in the example below.
Example: If the weighing system has 4 pcs 1000 kg load cells, then enter 4000 kg.

Average Load Cell Output: Enter the load cell output in mV/V. If the weighing system has more than one load cell, calculate the mean value of the load cells output as indicated in the certificates of the individual load cells.

Example: If the load cell outputs are LC1: 2.0010, LC2: 1.9998, LC3:1.9986 and LC4:2.0002, the mean value will be LC output = (2.0010 + 1.9998 + 1.9986 + 2.0002) ÷ 4 = 1.9999 mV/V.

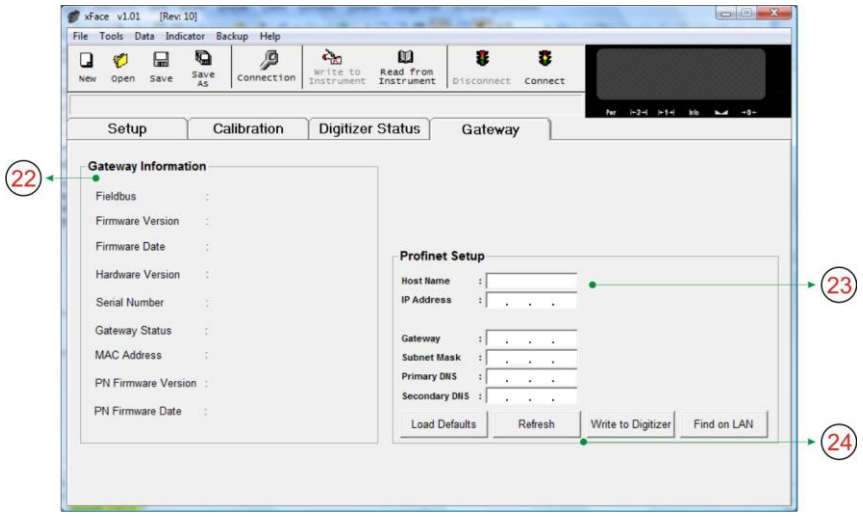
Estimated Dead Load: Enter the estimated dead load value of the weighing system in kg. You may perform a zero adjustment in convenient time for an exact dead load compensation.
After pressing “Save eCal Data to Converter” these data will be transferred to the instrument and eCal will be finalized.
If the scale is empty and you want to make an automatic zero adjustment instead of entering an estimated dead load, then press the “eCal with Zero Adjustment” button for starting the zero calibration. The display will show the [WAIT] message during the zero adjustment for approximately 5 seconds. In this period the scale must be unloaded and stable. The eCal calibration coefficients are saved automatically.

5.4. A/D Converter Performance Test

The scale performance test should be performed before you install the bus connection. The tests are linearity, repeatability and eccentricity. You can follow the test at the virtual display and/or status tab which show the measurement data, the instrument data and the software version. For convenience keys for Taring, Zeroing and Clear are located in this tab.

5.5. Bus Interface Setup

FAD-30 instruments have a bus interface and these parameters have to be setup before the bus will be connected. Bus communication settings are done in the Gateway tab.
Bus communication parameters and their descriptions can be found in the related instrument chapters.



22 **Gateway Information:** Gives the user info about the bus interface

23 **Communication setup:** Network parameters

24 **Load Defaults:** Loads the default values

Refresh: Reads the settings from the instrument and updates the window

Write to Converter: Saves and activates the settings to the instrument

Find on Network: Search for the instrument on the network

Figure 5.8 – Bus Interface Setup

5.6. Bus Addressing via Setup Switch

The bus addressing of FAD-30 instruments is done by the xFace software (Refer to chapter 5.3.1). The alternative way for addressing is the setup switch on the front panel for addresses between 0 and 7 for RS-485, Modbus RTU, Profibus and CANopen interfaces. This feature gives you the practical advantage for addressing the instrument up to address 7 without requiring a PC connection.
For addressing via the setup switch, press this switch for 5 seconds. Then the status LEDs indicate the bus address as shown in the table below. If the address is higher then 7 all LEDs are flashing. The address can be changed by pressing the setup switch sequentially. To save and exit, press the setup switch for 5 seconds. To return to normal operation without saving, wait 15 seconds without pressing the switch.

▬	→0←	Err	Address Number
○	○	○	0 (No address)
○	○	●	1
○	●	○	2
○	●	●	3
●	○	○	4
●	○	●	5
●	●	○	6
●	●	●	7
✸	✸	✸	Higher than 7

○ Off ● On ✸ Flash

Table 5.2 – Bus Addressing via Setup Switch

5.7. Back up Settings and Calibration Data

The parameter settings and the calibration coefficients can be saved to a backup file after reading these data from the FAD-30 instrument. This backup file can be re-written to FAD-30 after opening it by xFace.
The backup feature gives a service advantage to FAD-30 instruments. We propose to burn these files to CD / DVD and save this backup CD / DVD in the control cabinet additionally to a backup file on your PC.

Important note: The previous parameter settings and calibration coefficients in FAD-30 will get lost after loading a backup to the instrument.

5.8. Continuous Output Data Structure (for FAD-30 + FAD-30MB only)

The continuous data output of the instrument will be transmitted in the following data structure at the speed which is determined by the baud rate and the data length. The definition of the continuous data format is described below.

In weighing mode and force mode:

	Status			Indicated						Tare								
STX	STA	STB	STC	D5	D4	D3	D2	D1	D0	D5	D4	D3	D2	D1	D0	CR	LF	CHK

In count mode:

	Status	Count Data								Not used								
STX	STB	D7	D6	D5	D4	D3	D2	D1	D0	D5	D4	D3	D2	D1	D0	CR	LF	CHK

The definition of the status bytes STA, STB and STC is described below.

Definition Table for Status A (STA)									
Bits 0, 1 and 2				Bits 3 and 4			Bit 5	Bit 6	Bit 7
0	1	2	Decimal point	3	4	Increment size	Always 1	Always 1	X
0	0	0	XXXXOO	1	0	X 1			
1	0	0	XXXXXO	0	1	X 2			
0	1	0	XXXXXX	1	1	X 5			
1	1	0	XXXXX.X						
0	0	1	XXXX.XX						
1	0	1	XXX.XXX						
0	1	1	XX.XXXX						
1	1	1	X.XXXXX						

Definition Table for Status B (STB)		
Bit 0	Gross = 0	Net = 1
Bit 1	Weight positive = 0	Weight negative = 1
Bit 2	No Error = 0	Error = 1
Bit 3	Stable = 0	Unstable = 1
Bit 4	Always = 1	
Bit 5	Always = 1	
Bit 6	Not power on zeroed	Zeroed with power on zero = 1
Bit 7	x	

Definition Table for Status C (STC)		
Bit 0	Always 0	
Bit 1	Always 0	
Bit 2	Always 0	
Bit 3	Always 0	
Bit 4	Always 1	
Bit 5	Always 1	
Bit 6	Always 0	
Bit 7	x	

CHK (Checksum) = 0 – (STX + STATUS A + ... + LF)

Error Messages: UNDER, OVER, A.OUT, L-VOLT, H-VOLT are annunciated in the Indicated or Count Data fields.

Note: Weight data is represented with right alignment, error messages with left alignment.

5.9. BSI Data Structure (for FAD-30 + FAD-30MB only)

Depending on their functionality all new generation Flintec instruments launched on the market support the standardized command set with BSI data structure. This easy data format gives a reliable and fast interface for communicating with PLC or PC for process control or transactional applications. You can expand your system with additional scales from Flintec without having to change your application program base.

General Rules:

1. Commands are only in CAPITAL letters
2. CHK (2 ASCII char) can be enabled or disabled from both command and response.
3. Weight data is 8-byte with dot and non-significant zeros on the left.
4. Address (2 ASCII char) will be located in the structure if not 00.

Command format:

A general description of the command is the following:
[ADR][COMMAND][CHK][CR][LF]

Response format with weight / force or count data
A general description of the response is the following:
[ADR][COMMAND][STATUS][SIGN][WEIGHT/FORCE/COUNT][CHK][CR][LF]

Response format without weight / force or count data
[ADR][COMMAND][STATUS][CHK][CR][LF]

Command Table:

A	Read all weight data immediately
B	Read Gross weight value immediately
C	Clear the tare memory
D	Read Count value immediately
I	Read current (indicated) weight value immediately
P	Print: Read the current stable weight value
S	Read Status
T	Tare
X	Read current weight value in increased resolution immediately
Z	Zero

Status Table:

A	Acknowledged, the command is operated successfully
D	Unstable weight
E	Errors except of H, L, O, +, −
H	High voltage detected
I	The weight is in range
L	Low voltage detected
N	Not acknowledged, the command couldn't be operated
O	ADC out
S	Stable weight
X	Syntax error (received command not recognized)
+	Overload
−	Underload

Note: CHK, CR and LF will not be shown in the below data format descriptions in this chapter.

Commands and Responses

A	Read all weight data

Command: [ADR][A]
Response: [ADR][A][STATUS][SIGN][NET W][SIGN][TARE W][SIGN][GROSS W]
Example:

Command : 01A
Response : 01AS+000123.4+000111.1+000234.5
01AD+000123.4+000111.1+000234.5
01AO (ADC out error)

Comments: The response is net, tare and gross weight values or error status. All weight data will be transmitted immediately after receiving the command.

B	Read Gross weight

Command: [ADR][B]
Response: [ADR][B][STATUS][SIGN][WEIGHT VALUE]
Example:

Command: 01B
Response: 01BS+000123.4 (gross weight is stable and 123.4)
01BD+000123.4 (gross weight is unstable and 123.4)
01B− (under load)

Comments: The response is the gross weight value (stable or unstable) or error status. Gross weight data will be transmitted immediately after receiving command.

C	Clear the tare memory

Command: [ADR][C]
Response: [ADR][C][A] (Cleared and the scale is in gross mode)
[ADR][C][X] (Clear command is unavailable in count mode)
Comments: The response status is always Ack in weighing or force mode and always X in count mode.

D	Read Count value immediately

Command: [ADR][D]
Response: [ADR][D][STATUS][SIGN][COUNT VALUE]
Example:

Command: 01D
Response: 01DD+00123400
01DO (ADC out error)
01DX (Not in count mode)

Comments: Count value will be sent immediately.

I	Read indicated weight

Command: [ADR][I]
Response: [ADR][I][STATUS][SIGN][WEIGHT VALUE]
Example:

Command: 01I
Response: 01IS+000123.4 (weight is stable and 123.4)
01ID+000123.4 (weight is unstable and 123.4)
01I+ (overload)

Comments: The response is the indicated weight value (stable or unstable). It will be transmitted immediately after receiving the command. The weight value may be in gross or net.

P	Print :Read the stable weight

Command: [ADR][P]
Response: [ADR][P][STATUS][SIGN][WEIGHT VALUE]
Example:

Command: 01P
Response: 01PS+000123.4 (weight is stable and 123.4) or
01PN (could not print)

Comments: Checks status and it must be stable. Else Nack status will be sent. There is no time period for stability checking. Status can be Stable or Nack.

S	Read Status

Command: [ADR][S]
Response: [ADR][S][STATUS-1][STATUS-2][STATUS-3]
Example:

Command:	01S	
Response:	01SSGI	(Stable, Gross, In Range)
	01SDGL	(Unstable, Gross, Low voltage error)

Comments: The response includes 3 status information.
STATUS-1 can be Stable or Unstable.
STATUS-2 can be Gross or Net.
STATUS-3 can be 'in range', 'out of range', 'low voltage' or 'high voltage'.

T	Tare

Command: [ADR][T]
Response:

[ADR][T][A]	(Taring is done successfully and scale is in net)
[ADR][T][N]	(Taring could not be executed)
[ADR][T][X]	(Taring is disabled or instrument is in count mode)

Comments: The tare value will be overwritten by the new tare weight value. The status must be stable within 2 seconds delay time. If so, Ack will be sent. Otherwise Nack will be sent.

X	Read weight value in increased resolution

Command: [ADR][X]
Response: [ADR][X][STATUS][SIGN][WEIGHT VALUE]
Example:

Command:	01X	
Response:	01XS+00123.41	(weight is stable and 123.41) or
	01XD+00123.41	(weight is unstable and 123.41) or
	01XE	(Error)

Comments: The response includes the weight data with the increment divided by 10.

Z	Zero

Command: [ADR][Z]
Response:

[ADR][Z][A]	(Zeroed)
[ADR][Z][N]	(Zeroing could not be operated)
[ADR][Z][X]	(Zeroing is disabled)

Comments: The Zero command does not work in net weighing mode. The Weight or Count must be within the zeroing range for all operating modes. The status must be stable within 2 seconds delay time. If so, Ack will be sent. Otherwise Nack will be sent.

CHK will be transmitted as two ASCII characters calculated with the checksum formula:
Checksum = 0 – (SUM of all response data before CHK)

Example: Read stable current weight data

BSI Examples: (CHK is enabled and instrument address is 01)

Command: 01P[CHK][CR][LF]

Checksum = 0 − (0x30 + 0x31 + 0x50) = 0 − 0XB1 = 0x4F
CHK = Char '4' and 'F'

Response: 01PS+000123.4[CHK][CR][LF]

Checksum = 0 − (0x30 + 0x31 + 0x50 + 0x53 + 0x2B + 0x30 + 0x30 + 0x30 + 0x31+ 0x32 + 0x33 + 0x2E + 0x34) = 0 − 0x02B7 = 0x49:
CHK = Char '4' and Char '9'

5.10. Modbus Data Structure (for FAD-30MB + FAD-30EN only)

Address	R/W	Word	Command	Definition			
40001	R	2	Weight / Force / Count Data				
40003	R	1	Status	D0	0 – System Ready	1 – System Busy	
				D1	0 – Error	1 – Data ok	
				D2	0 – Weight Stable	1 – Weight unstable	
				D3	0 – Gross Mode	1 – Net mode	
				D4	Not Used		
				D5	0 – Weight / Force	1 – Count Mode	
				D6-D11		Not Used	
				D12	0 – Out of zero range	1 – Weight is in zero range	
				D13 D14 D15	Error Code	0	No Errors
						1	ADC out of range
						2	ADC over range
						3	ADC under range
						4	System error
						5	In setup mode
						6	Low/High voltage det.
40004	R	2	Tare weight				
40006	R	2	Gross weight				
40008	R	1	Status	Motion, Net mode, Data ok, (image of register 40003)			
40009	R/W	1	Control	0	None		
				1	Zero		
				2	Tare		
				3	Clear		
40010	R/W	1	Calibration	0	None		
				188	Adjust Zero Calibration		
				220	Adjust Span Calibration (First load calibration weight on scale and load 40011 with span test weight value)		
40011	R/W	2	Span Calibration Value				
40013	R	1	Calibration Status	D0 .. D7 Calibration Process Status	1	Ready for calibration	
					3	Zero calibration in process	
					4	Span calibration in process	
					9	Error (Refer to D8 ... D15)	
				D8 .. D15 Calibration Errors	1	Calibration Timeout - Restart calibration	
					2	ADC Error - Re-energize the instrument - If seen again, change the board.	
					3	Instrument cannot be calibrated - Check load cell cable - Re-energize the instrument	
					34	Instrument cannot be calibrated - Load cell signal is very low or too high	
					35	Calibration Error - Calibration test weight is not enough - Increase calibration weight value (40011) - Check load cell connections	
					37	Scale unstable - Wait until scale become stable - Check grounding wiring	
40014	R/W	1	Operation Mode Selector	0	Count Mode Unipolar		
				1	Count Mode Bipolar		
				2	Force Mode Unipolar		
				3	Force Mode Bipolar		
				4	Weight Mode Unipolar		

Address	R/W	Word	Command	Definition	
40015	R/W	1	mV operation in Count Mode	0	5 mV
				1	10 mV
				2	15 mV
				3	18 mV
40016	R/W	1	Digital filters	0	Fast
				1	
				2	
				3	
				4	
				5	Medium
				6	
				7	Default
				8	
				9	Slow

EXPLANATION

Attention: For hardware connection details, please refer to the related hardware descriptions in this manual.

In the two word registers the data is stored to the registers in big-endian format. The least significant word is stored to the highest register address; and the most significant word is stored to the lowest register address. Please find Modbus information in the web site of http://www.modbus.org

Exception codes:

1: Function code is not supported.
2: Out of address range
3: Invalid value or wrong byte number
4: Operation error

Examples:

Performing Read and Write operations according to hex system with the instrument set to address “0x01”.

Request weight data: 01,03,00,00,00,02,C4,0B
Answer of requested weight: 01,03,04,00,01,86,A0,38,4A
Weight is 100000
Request status data: 01,03,00,02,00,01,25,CA
Taring: 01,10,00,08,00,01,02,00,02,26,D9
Request tare data: 01,03,00,03,00,02,34,0B
Answer of requested tare: 01,03,04,00,00,27,10,E0,0F
Tare is 10000
Weight Mode Selection: 01,10,00,0D,00,01,02,00,04,A6,8E
Count in Unipolar Mode Selection: 01,10,00,0D,00,01,02,00,00,A7,4D
5 mV Input signal range selection: 01,10,00,0E,00,01,02,00,00,A7,7E
Load Medium (5) to Digital filter: 01,10,00,0F,00,01,02,00,05,66,AC
Request Calibration Status: 01,03,00,0C,00,01,44,09
Answer of requested Calibration Status: 01,03,02,00,01,79,84
Instrument is ready for calibration
Zero Calibration Command: 01,10,00,08,00,01,02,00,01,66,D8
Span Calibration with Span Value 50000: 01,10,00,09,00,03,06,00,DC,00,00,C3,50,B7,B0

5.11. Profibus and ProfiNet Data Structure (for FAD-30Px only)

Hardware Configuration Hint

To install the FAD-30PB or FAD-30PN into the PLC Hardware Configuration use the GSD file memory parts to create **exactly** the following memory structure:

- Input 2 Words
- Output 2 Words
- Input 2 Words
- Input 2 Words
- Output 2 Words
- Output 2 Words

FAD-30Px Output to PLC Input

Dword	D31	D30	D29	D28	D27	D26	D25	D24	D23	D22	D21	D20	D19	D18	D17	D16
	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
1st Dword	Reserved															
2nd Dword	W31 MSB	W30	W29	W28	W27	W26	W25	W24	W23	W22	W21	W20	W19	W18	W17	W16
	W15	W14	W13	W12	W11	W10	W9	W8	W7	W6	W5	W4	W3	W2	W1	W0 LSB
3rd Dword	Not in use															
	Error codes of converter				Not in use		Op. mode	Zero range	Gross Net	MD	Read command response					Cmd Flag

FAD-30Px Output to PLC Input 2nd Dword

The 2nd Dword contains the weight value respective the calibration information according to the "read command response" (Refer to PLC Output to FAD-30Px Input 3rd Dword).

FAD-30Px Output to PLC Input 3rd Dword

Bit no.	**3rd Dword Description**		
D31…D16	Not in use		
D15…D12	Error codes of converter	0000	No error found
		0001	ADC out
		0010	ADC over
		0011	ADC under
		0100	System error
		0101	In setup mode
		0110	Low/High voltage error
		0111	Instrument not found
D11…D10	Not in use		
D9	Operation mode	0	Weight & Force Mode
		1	Count Mode
D8	Zero range	0	Weight is out of zero range
		1	Weight is in zero range
D7	Indication	0	Gross
		1	Net
D6	MD – Motion detection	0	Stable
		1	Unstable
D5 D4 D3 D2 D1	Read command response	00000	Indicated weight
		00001	Gross weight
		00010	Tare weight
		00011	Indicated weight (floating point type)
		00100	Gross weight (floating point type)
		00101	Tare weight (floating point type)
		10000	Calibration Status (Refer to table 8.2)
D0	CMD flag	A change of Flag indicates: The command is applied successfully	

Calibration Status

Bit no.	**2nd Dword descriptions when read command is 'Calibration Status'. Refer to PLC Output to FAD-30Px Input 3rd Dword**		
D31…D16	Not in use		
D15…D8	Calibration error	0000 0001	Calibration timeout: - Restart calibration
		0000 0010	ADC error: - Re-energize the instrument
		0000 0011	Instrument cannot be calibrated - Check load cell cable; - Re-energize the instrument
		0010 0010	Instrument cannot be calibrated - Load cell signal is very low or too high
		0010 0011	Calibration Error - Calibration test weight is too small; Increase calibration weight value (Write test weight value from PLC Output to FAD-30Px Input 2nd Dword then restart the calibration) - Check load cell connections
		0010 0101	Scale unstable: - Wait until scale becomes stable - Check ground wiring
D7...D0	Calibration process status	0000 0001	System ready for calibration
		0000 0011	Zero calibration in process
		0000 0100	Span calibration in process
		0000 1001	Error (Calibration error)

PLC Output to FAD-30Px Input

Dword	D31	D30	D29	D28	D27	D26	D25	D24	D23	D22	D21	D20	D19	D18	D17	D16
	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
1st Dword	Not in use															
2nd Dword	W31 MSB	W30	W29	W28	W27	W26	W25	W24	W23	W22	W21	W20	W19	W18	W17	W16
	W15	W14	W13	W12	W11	W10	W9	W8	W7	W6	W5	W4	W3	W2	W1	W0 LSB
3rd Dword	Not in use															
	Not in use					Command List					Data Selection					New CMD

PLC Output to FAD-30Px Input 2nd Dword

The 2nd Dword contains the setting / parameter value (Refer to “Command List”, see PLC Output to FAD-30Px Input 3rd Dword).

PLC Output to FAD-30Px Input 3rd Dword

Bit no.	3rd Dword descriptions				
D31…D11	Not in use				
D10…D6	Command list	00000	No command is activated		
		00001	Zero		
		00010	Tare		
		00011	Clear		
		00101	Adjust zero calibration		
		00110	Adjust span calibration (First load calibration weight on scale then load 2nd Dword with span test weight value*, then apply this command with New CMD)		
		01000	Operation mode selection (First load 2nd Dword with selected value, then apply this command with New CMD)	Load 2nd Dword with one of these: 0: Count mode unipolar 1: Count mode bipolar 2: Force mode unipolar 3: Force mode bipolar 4: Weight mode unipolar	
		01001	mV operation in Count Mode (First load 2nd Dword with selected value, then apply this command with New CMD)	Load 2nd Dword with one of these: 0: 5 mV 1: 10 mV 2: 15 mV 3: 18 mV	
		01010	Digital filter (First load 2nd Dword with selected value, then apply this command with New CMD)	Load 2nd Dword with one of these: 0: Fast … 5: Medium …	 … 7: Default … 9: Slow
D5...D1	Read selected data	00000	Indicated weight		
		00001	Gross weight		
		00010	Tare weight		
		00011	Indicated weight (Floating point)		
		00100	Gross weight (Floating point)		
		00101	Tare weight (Floating weight)		
		10000	Calibration status		
D0	New CMD	Apply commands which are listed in “Command list” (Responds on bit changes)			

*Span test weight value has to be entered ignoring the decimal point;
e.g. “300.00” has to be entered as “30000”

5.12. CANopen Data Structure (for FAD-30CO only)

Hardware Configuration Hint

To install the FAD-30CO into the PLC Hardware Configuration use the ESD file memory parts to create **exactly** the following memory structure:

- Input 2 Words
- Output 2 Words
- Input 2 Words
- Input 2 Words
- Output 2 Words
- Output 2 Words

FAD-30CO Output to PLC Input

Dword	D31	D30	D29	D28	D27	D26	D25	D24	D23	D22	D21	D20	D19	D18	D17	D16
	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
TxPDO 1 (T_DW1)	reserved															
TxPDO 2 (T_DW2)	W31 MSB	W30	W29	W28	W27	W26	W25	W24	W23	W22	W21	W20	W19	W18	W17	W16
	W15	W14	W13	W12	W11	W10	W9	W8	W7	W6	W5	W4	W3	W2	W1	W0 LSB
TxPDO 3 (T_DW3)	Not in use															
	Error codes of converter				Not in use			Op. mode	Zero range	Gross Net	MD	Read command response				Cmd Flag

FAD-30CO Output to PLC Input T_DW2

T_DW2 contains the weight value respective the calibration information according to the “read command response” (Refer to FAD-30COOutput to PLC Input T_DW3).

FAD-30CO Output to PLC Input T_DW3

Bit no.	**T_DW3 Description**		
D31…D16	Not in use		
D15…D12	Error codes of converter	0000	No error found
		0001	ADC out
		0010	ADC over
		0011	ADC under
		0100	System error
		0101	In setup mode
		0110	Low/High voltage error
		0111	Instrument not found
D11…D10	Not in use		
D9	Operation mode	0	Weight & Force Mode
		1	Count Mode
D8	Zero range	0	Weight is out of zero range
		1	Weight is in zero range
D7	Indication	0	Gross
		1	Net
D6	MD – Motion detection	0	Stable
		1	Unstable
D5 D4 D3 D2 D1	Read command response	00000	Indicated weight
		00001	Gross weight
		00010	Tare weight
		00011	Indicated weight (floating point type)
		00100	Gross weight (floating point type)
		00101	Tare weight (floating point type)
		10000	Calibration Status (Refer to table 8.2)
D0	CMD flag	A change of the flag indicates: New CMD is applied successfully	

Calibration Status

Bit no.	**T_DW2 descriptions when read command is 'Calibration Status'. Refer to PLC Output to FAD-30CO Input R_DW3**		
D31…D16	Not in use		
D15…D8	Calibration error	0000 0001	Calibration timeout: - Restart calibration
		0000 0010	ADC error: - Re-energize the instrument
		0000 0011	Instrument cannot be calibrated - Check load cell cable - Re-energize the instrument
		0010 0010	Instrument cannot be calibrated: - Load cell signal is very low or too high
		0010 0011	Calibration Error - Calibration test weight is too small; - Increase calibration weight value (Write test weight value from PLC Output to FAD-30CO Input R_DW2 then restart the calibration) - Check load cell connections
		0010 0101	Scale unstable - Wait until scale becomes stable - Check ground wiring
D7…D0	Calibration process status	0000 0001	System ready for calibration
		0000 0011	Zero calibration in process
		0000 0100	Span calibration in process
		0000 1001	Error (Calibration error)

PLC Output to FAD-30CO Input

Dword	D31	D30	D29	D28	D27	D26	D25	D24	D23	D22	D21	D20	D19	D18	D17	D16
	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
RxPDO 1 (R_DW1)	Reserved															
RxPDO 2 (R_DW2)	W31 MSB	W30	W29	W28	W27	W26	W25	W24	W23	W22	W21	W20	W19	W18	W17	W16
	W15	W14	W13	W12	W11	W10	W9	W8	W7	W6	W5	W4	W3	W2	W1	W0 LSB
RxPDO 3 (R_DW3)	Not in use															
	Not in use							Command List				Data Selection				New CMD

PLC Output to FAD-30CO Input R_DW 2

R_DW 2 contains the setting / parameter value (Refer to “Adjust span calibration” and “I/O configuration” in “Command List”, see PLC Output to FAD-30CO Input R_DW3).

PLC Output to FAD-30CO Input R_DW3

Bit no.	R_DW3 descriptions				
D31…D11	Not in use				
D10…D6	Command list	00000	No command is activated		
		00001	Zero		
		00010	Tare		
		00011	Clear		
		00101	Adjust zero calibration		
		00110	Adjust span calibration (First load calibration weight on scale then load R_DW2 with span test weight value*, then apply this command with New CMD)		
		01000	Operation mode selection (First load 2nd Dword with selected value, then apply this command with New CMD)	Load R_DW2 with one of these: 0: Count mode unipolar 1: Count mode bipolar 2: Force mode unipolar 3: Force mode bipolar 4: Weight mode unipolar	
		01001	mV operation in Count Mode (First load 2nd Dword with selected value, then apply this command with New CMD)	Load R_DW2 with one of these: 0: 5 mV 1: 10 mV 2: 15 mV 3: 18 mV	
		01010	Digital filter (First load 2nd Dword with selected value, then apply this command with New CMD)	Load R_DW2 with one of these: 0: Fast … 5: Medium …	 … 7: Default … 9: Slow
D5...D1	Read selected data	00000	Indicated weight		
		00001	Gross weight		
		00010	Tare weight		
		00011	Indicated weight (Floating point)		
		00100	Gross weight (Floating point)		
		00101	Tare weight (Floating weight)		
		10000	Calibration status		
D0	New CMD	Apply commands which are listed in “Command list” (Responds on bit changes)			

*Span test weight value has to be entered ignoring the decimal point;
e.g. “300.00” has to be entered as “30000”

6. FAD-30 / FAD-30MB – WITH RS-485 INTERFACE

FAD-30 and FAD-30MB instruments are state-of-the-art strain gauge load cell signal digitizers with RS-485 interface. These instruments are used for any type of process weighing and force measurement including tank and silo weighing, dynamic weighing, check weighing, filling, tension /compression force measurement etc.

6.1. Front View

There are 3 status LEDs on the front panel which indicate the operational instrument status (Refer to table 6.1).
The setup switch on front panel of the instrument is used for RS-485 addressing without PC (Refer to chapter 5.6) and for diagnostics (Refer to chapter 12).
When the error LED is ON, the other two LED indicate the error type (Refer to chapter 11 for details).
Load cell connection, power supply and serial interface terminals are located at the front of the DIN rail mount instrument (See figure 6.1).

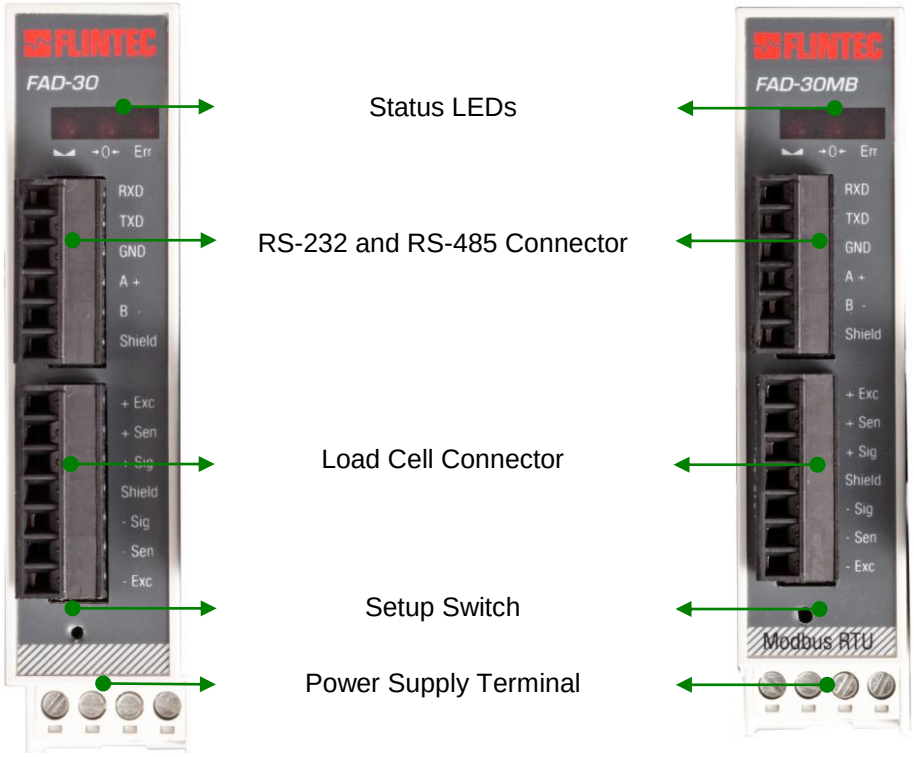


Figure 6.1 – Front view

The meanings of these LEDs in operation are described below.

LED		Operational Mode	
Symbol	Name	Weight / Force	Count
▂▃	Stable	● Stable ○ Unstable	◐ Off for 0.3 seconds in 2 seconds period (No stable indication)
→0←	Centre of Zero	● in the centre of zero range (-0.25 e < w < 0.25 e) ○ Out of centre of zero range	○ Always off (No centre of zero indication)
Err	Error (*)	● ADC conversion error ✹ Digital processing error ○ No error	● ADC conversion error ✹ Digital processing error ○ No error

○ Off ● On ✹ Flashing ◐ Off for 0.3 seconds

(*) : Refer to the error table in chapter 11

Table 6.1 – Status LEDs

6.2. Electrical Connections

RS-232 and RS-485 connections are shown in figure 6.2.

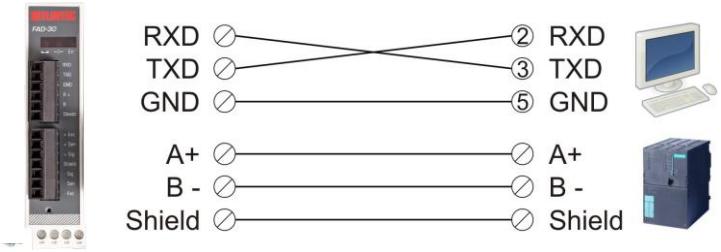


Figure 6.2 – FAD-30 / FAD-30MB serial interface connections

RS-232C Serial Interface

Use	Interfacing with PC or PLC, setup via xFace
Data format	Continuous, BSI (Default)
Baud rate	9600 bps
Length and parity	8 bit, no parity
Start / Stop bits	1 start bit and 1stop bit

RS-485 Serial Interface

Use	Interfacing with PC or PLC, setup via xFace
Data format	Continuous, BSI (Default for FAD-30), Modbus RTU (for FAD-30MB only, default)
Baud rate	1200 / 2400 / 4800 / 9600 (Default) / 19200 / 38400 / 57600 bps
Length and parity	8 bit, no parity
Start / Stop bits	1 start bit and 1stop bit

Warning: Connect the shield to the reference ground.
Warning: Disconnect xFace PC software for Modbus-RTU interfacing

Load Cell Connection

See chapter 4.2.2

Power Supply Connection

See chapter 4.2.1

6.3. Interfacing

FAD-30 and FAD-30MB instruments have two serial interface connectors on the front of the instrument: RS-232 and RS-485. The table below describes the data format for interfacing the peripherals and their application:

Data Format	Description	Application	Hardware
Continuous	Asynchronous continuous output. Refer to chapter 5.8	Continuous data transfer to PC or PLC Remote display connection Remote Taring, Zeroing	RS-232C RS-485
BSI	Demand interface on BSI Serial Interface format. Refer to chapter 5.9	Master – Slave data interfacing with PLC or PC.	RS-232C RS-485
Modbus RTU (FAD-30MB only)	Modbus RTU interfacing. Refer to chapter 5.10	Interfacing with PLC.	RS-485

Table 6.1 – Data output interfacing

Attention: Please disable the interface if not used to increase the performance of the instrument.

6.4. Setup and Calibration

FAD-30 and FAD-30MB instruments are set up and calibrated by xFace. The A/D Converter settings are very important for a good weighing performance. Please refer to chapter 5.3.

6.5. Modbus RTU Setup (for FAD-30MB only)

If the FAD-30MB instrument is setup for Modbus, it can be used as a Modbus RTU slave in a RS-485 communication network. Function codes ‘0x03’ and ‘0x10’ are supported. For RS-485 setup please refer to chapter 5.3.2, for the Modbus data structure please refer to chapter 5.10.

7. FAD-30PB – WITH PROFIBUS INTERFACE

FAD-30PB instruments are state-of-the-art strain gauge load cell signal digitizers with Profibus DP interface. These instruments are used for any type of process weighing and force measurement including tank and silo weighing, dynamic weighing, check weighing, filling, tension /compression force measurement etc.
The GSD file is available on a CD which is supplied together with the instrument.

7.1. Front View

There are 5 status LEDs on the front panel which indicate the operational instrument status (Refer to table 7.1).and the Profibus status. The setup switch on front panel of the instrument is used for Profibus addressing without PC (Refer to chapter 5.6) and for diagnostics (Refer to chapter 12).
When the error LED is ON, the other two LED indicate the error type (Refer to chapter 11 for details).
Load cell connection, Profibus connection, power supply and serial interface terminals are located at the front of the DIN rail mount instrument (See figure 7.1).

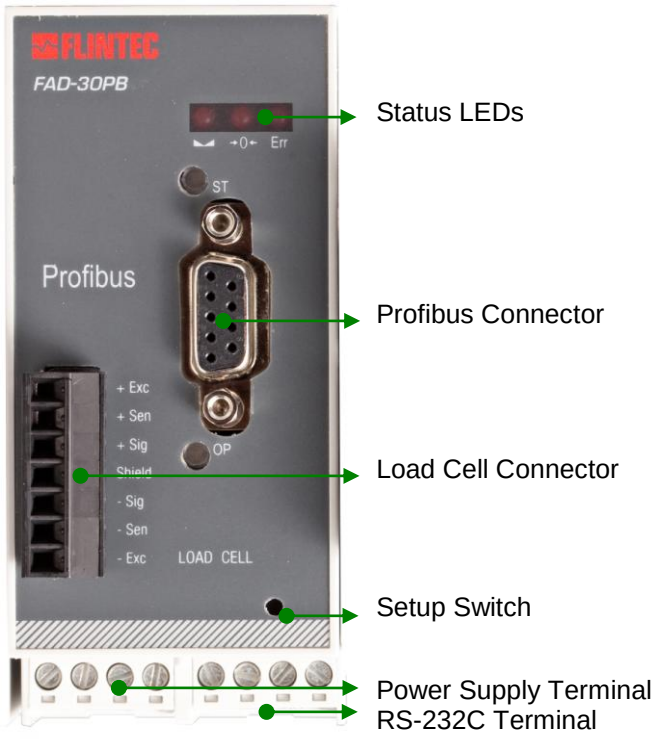


Figure 7.1 – Front view

The meanings of these LEDs in operation are described below.

LED		Operational Mode	
Symbol	**Name**	**Weight / Force**	**Count**
▂▃▂	Stable	● Stable ○ Unstable	◐ Off for 0.3 seconds in 2 seconds period (No stable indication)
→0←	Centre of Zero	● in the centre of zero range (-0.25 e < w < 0.25 e) ○ Out of centre of zero range	○ Always off (No centre of zero indication)
Err	Error (*)	● ADC conversion error ✹ Digital processing error ○ No error	● ADC conversion error ✹ Digital processing error ○ No error

○ Off ● On ✹ Flashing ◐ Off for 0.3 seconds

(*) : Refer to the error table in chapter 11.

Table 7.1 – Status LEDs

ST Status LED

State	Indication	Comment
Off	No power or not initialized	No power or profibus module is in initializing
Green	Initialized	
Flashing Green	Initialized, diagnostic event(s) present	Diagnostic is active
Red	Exception error	There is an exception error

OP Operation Mode LED

State	Indication	Comment
Off	Not on-line / No power	Check power and cable
Green	On-line, data exchange	-
Flashing Green	On-line, clear	-
Flashing Red (2x)	PROFIBUS configuration error	Check GSD file configuration.

7.2. Electrical Connections

Profibus and RS-232C connections are shown in figure 7.2.

PROFIBUS Connector (DB9F)

Pin	Signal	Description
1	-	-
2	-	-
3	B Line	Positive RxD / TxD, RS-485 level
4	RTS	Request to send
5	GND Bus	Ground (isolated)
6	+5V Bus output	+5V termination power (isolated)
7	-	-
8	A Line	Negative RxD / TxD, RS-485 level
9	-	-
Housing	Cable shield	Ground

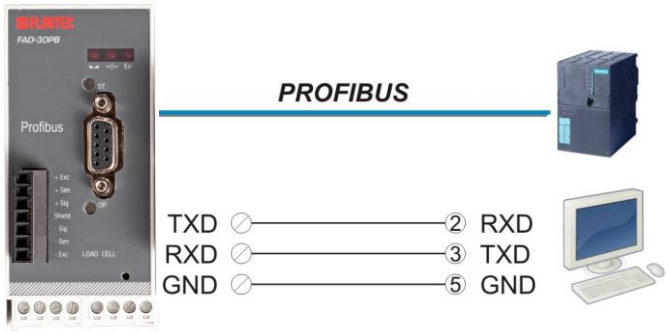


Figure 7.2 – FAD-30PB interface connections

RS-232C Serial Interface

Use	Setup via xFace
Baud rate	9600 bps
Length and parity	8 bit no parity
Start / Stop bits	1 start bit and 1stop bit

Profibus-DP Interface

Use	Interfacing with PC or PLC
Data format	Profibus
Baud rate	Automatically detected and supported baud rates are 9.6 kbps, 19.2 kbps, 45.45 kbps, 93.75 kbps, 187.5 kbps, 500 kbps, 1.5Mbps, 3 Mbps, 6 Mbps and 12 Mbps. No 'baud rate' instance exists.

Warning: Connect the shield to the reference ground or shield pin of the power connector.
Warning: Disconnect xFace PC software for Profibus interfacing.

Load Cell Connection

See chapter 4.2.2

Power Supply Connection:

See chapter 4.2.1

7.3. Interfacing

FAD-30PB instruments have two interface connectors on the front of the instrument: Profibus and RS-232C. The table below describes the data formats for interfacing the peripherals and their application.

Data Format	Description	Application	Hardware
Profibus	Profibus interfacing. Refer to chapter 5.11	Interfacing with PLC	Profibus-DP-V1

Table 7.2 – Data output interfacing

Attention: Please disable the interface you will not use to increase the performance of the instrument.

7.4. Setup and Calibration

FAD-30PB instruments are set up and calibrated by xFace. The A/D Converter settings are very important for a good weighing performance. Please refer to chapter 5.3.

7.5. Profibus Setup

The Profibus setup is done by xFace software as described in this chapter. Select the Gateway tab after connecting xFace to the instrument. You will see the Profibus parameters in this tab.

Profibus Setup

There is only one setup parameter for Profibus network.

Profibus Rack Address	The address range is 1 (default setting) to 126

Profibus DP Data Structure

Please refer to chapter 5.11

8. FAD-30PN – WITH PROFINET INTERFACE

FAD-30PN instruments are state-of-the-art strain gauge load cell signal digitizers with ProfiNet interface. These instruments are used for any type of process weighing and force measurement including tank and silo weighing, dynamic weighing, check weighing, filling, tension /compression force measurement etc.
The EDS file is available on a CD which is supplied together with the instrument.

8.1. Front View

There are 6 status LEDs on the front panel which indicate the operational instrument status (Refer to table 8.1). and the ProfiNet status. The setup switch on front panel of the instrument is used for ProfiNet addressing without PC (Refer to chapter 5.6) and for diagnostics (Refer to chapter 12).
When the error LED is ON, the other two LED indicate the error type (Refer to chapter 11 for details).
Load cell connection, ProfiNet connection, power supply and serial interface terminals are located at the front of the DIN rail mount instrument (See figure 8.1).

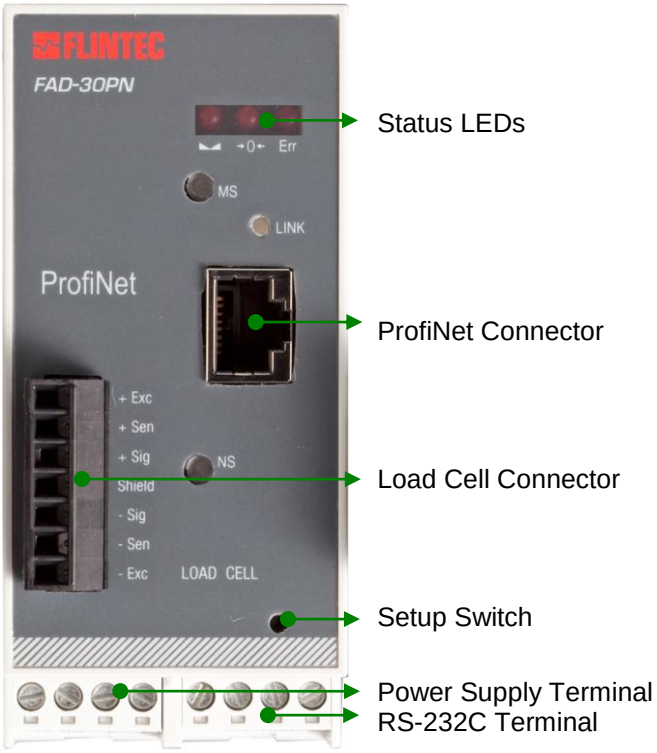


Figure 8.1 – Front view

The meanings of these LEDs in operation are described below.

LED		Operational Mode	
Symbol	Name	Weight / Force	Count
▂▅▂	Stable	● Stable ○ Unstable	◐ Off for 0.3 seconds in 2 seconds period (No stable indication)
→0←	Centre of Zero	● in the centre of zero range (-0.25 e < w < 0.25 e) ○ Out of centre of zero range	○ Always off (No centre of zero indication)
Err	Error (*)	● ADC conversion error ✹ Digital processing error ○ No error	● ADC conversion error ✹ Digital processing error ○ No error

○ Off ● On ✹ Flashing ◐ Off for 0.3 seconds

(*) : Refer to the error table in chapter 11.

Table 8.1 – Status LEDs

MS Module Status LED

LED State	Description	Comment
Off	No power or not initialized	No power or ProfiNet module is in initialization state
Green	Initialized	
Green, 1 flash	Initialized, diagnostic event(s) present	Diagnostic is active
Green, 2 flashes	Blink	Used by engineering tools to identify the node on the network
Red	Exception error	There is an exception error
Red, 1 flash	Configuration error	Check EDS configuration
Red, 2 flashes	IP address error	IP address not set
Red, 3 flashes	Station name error	Station name not set
Red, 4 flashes	Internal module error	Re-energize the instrument. If seen again, change the module.

LINK/Activity LED

LED State	Description	Comment
Off	No Link	No link, no communication present
Green	Link	Ethernet link established, no communication present
Green, flickering	Activity	Ethernet link established, communication present

NS Network Status LED

LED State	Description	Comment
Off	Not online /No power	Check power and cable
Green	On-line (RUN)	-
Green, flashing	On-line (STOP)	-

8.2. Electrical Connections

ProfiNet and RS-232C connections are shown in figure 8.2.

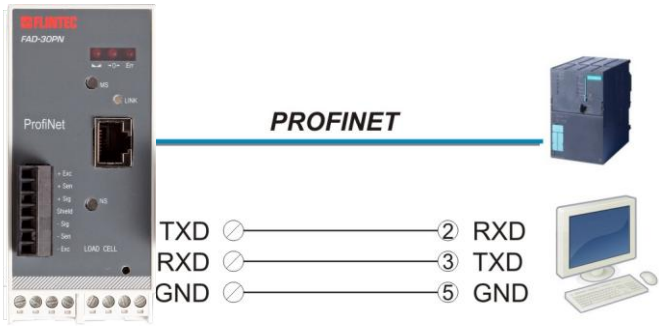


Figure 8.2 – FAD-30PN interface connections

RS-232C Serial Interface

Use	Setup via xFace
Baud rate	9600 bps
Length and parity	8 bit no parity
Start / Stop bits	1 start bit and 1stop bit

ProfiNet Interface

Use	ProfiNet interface with PC or PLC
Data format	ProfiNet
Ethernet	The Ethernet interface operates at 100Mbit, full duplex, as required by Profinet.

Warning: Connect the shield to the reference ground or the shield pin of the power connector.
Warning: Disconnect xFace PC software for ProfiNet interfacing.

Load Cell Connection

See chapter 4.4.2

Power Supply Connection

See chapter 4.2.1

8.3. Interfacing

FAD-30PN instruments have two interface connectors on the front of the instrument: ProfiNet and RS-232C. The table below describes the data formats for interfacing the peripherals and their application.

Data Format	Description	Application	Hardware
ProfiNet	ProfiNet interfacing. Refer to chapter 5.11	Interfacing with PLC.	ProfiNet

Table 8.3 – Data output interfacing

Attention: Please disable the interface you will not use to increase the performance of the instrument.

8.4. Setup and Calibration

FAD-30PN instruments are set up and calibrated by xFace. The A/D Converter settings are very important for a good weighing performance. Please refer to chapter 5.3.

8.5. ProfiNet Setup

The ProfiNet setup is done by xFace software as described in this chapter. Select the Gateway tab after connecting xFace to the instrument. You will see the ProfiNet parameters in this tab.

ProfiNet Setup

There are 7 setup parameters for ProfiNet network.

DHCP	Dynamic Host Configuration Protocol automates network parameters if it is enabled. Default is 'Disable'.
IP Address	If DHCP is disabled, define IP address manually. Default is '192.168.16.250'
Subnet Mask	If DHCP is disabled, define subnet mask manually. Default is '255.255.255.0'.
Default Gateway	If DHCP is disabled, define default gateway manually. Default is '192.168.16.254'.
Primary DNS	If DHCP is disabled, define primary DNS manually. Default is '208.67.222.222'.
Secondary DNS	If DHCP is disabled, define secondary DNS manually. Default is '208.67.220.220'.
Host Name	Enter a unique host name to the instrument. Default is ' '

ProfiNet Data Structure

Please refer to chapter 5.11

9. FAD-30EN – WITH ETHERNET INTERFACE

FAD-30EN instruments are state-of-the-art strain gauge load cell signal digitizers with Ethernet interface. These instruments are used for any type of process weighing and force measurement including tank and silo weighing, dynamic weighing, check weighing, filling, tension /compression force measurement etc.

9.1. Front View

There are 3 status LEDs on the front panel which indicate the operational instrument status (Refer to table 9.1).
The setup switch on front panel of the instrument is used for diagnostics (Refer to chapter 12)
When the error LED is ON, the other two LED indicate the error type (Refer to chapter 11 for details).
Load cell connection, Ethernet, power supply and serial interface terminals are located at the front of the DIN rail mount instrument (See figure 9.1).

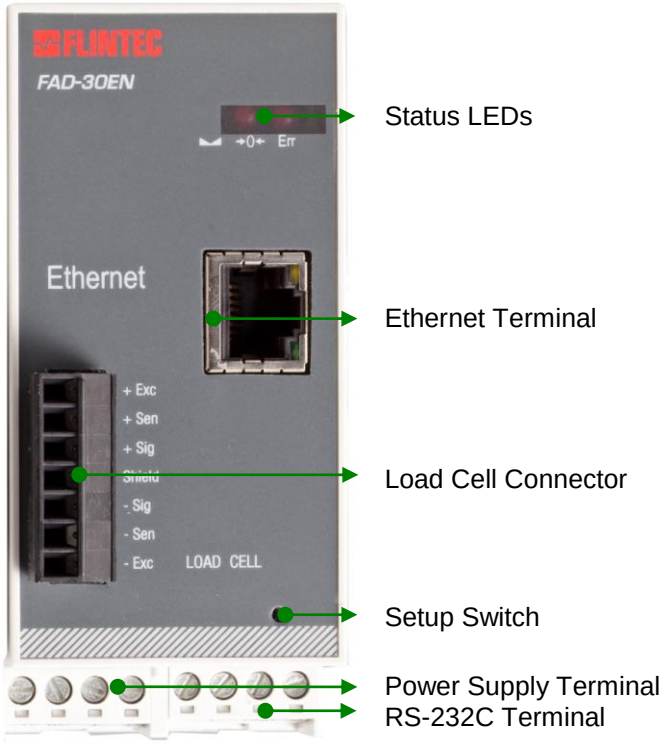


Figure 9.1 – Front view

The meanings of these LEDs in operation are described below.

LED		Operational Mode	
Symbol	Name	Weight / Force	Count
▂▃▅	Stable	● Stable ○ Unstable	◐ Off for 0.3 seconds in 2 seconds period (No stable indication)
→0←	Centre of Zero	● in the centre of zero range (-0.25 e < w < 0.25 e) ○ Out of centre of zero range	○ Always off (No centre of zero indication)
Err	Error (*)	● ADC conversion error ✹ Digital processing error ○ No error	● ADC conversion error ✹ Digital processing error ○ No error

○ Off ● On ✹ Flashing ◐ Off for 0.3 seconds

(*) : Refer to the error table in chapter 11

Table 9.1 – Status LEDs

9.2. Electrical Connections

Ethernet and RS-232C connections are shown in figure 9.2 to 9.4.

Ethernet Connector (RJ45)

Pin	Signal	DIR	Description
1	TX+	Out	Differential Ethernet transmit data +
2	TX−	Out	Differential Ethernet transmit data −
3	RX+	In	Differential Ethernet receive data +
6	RX−	In	Differential Ethernet receive data −
4	Not used		Terminated
5	Not used		Terminated
7	Not used		Terminated
8	Not used		Terminated
	Shield		Chassis ground

The HUB connection cabling will be a direct connection as shown below:

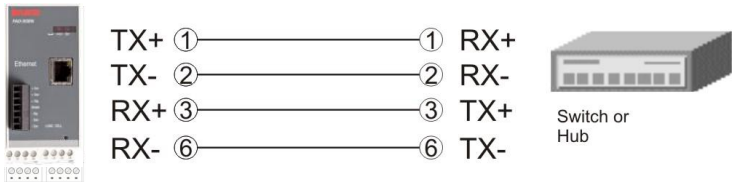


Figure 9.2 – HUB connection

The PC connection cabling will be done via cross cable as shown below:

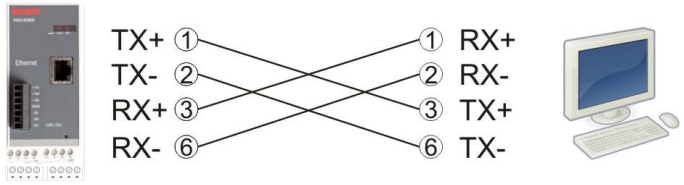


Figure 9.3 – Direct PC connection with cross cable

FAD-30EN interface connections are shown below:

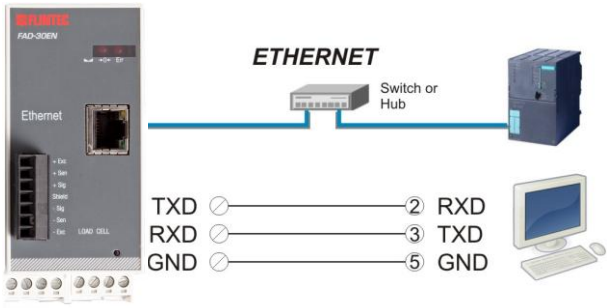


Figure 9.4 – FAD-30EN interface connections

RS-232C Serial Interface

Use	Setup via xFace
Baud rate	9600 bps
Length and parity	8 bit, no parity
Start / Stop bits	1 start bit and 1stop bit

Ethernet Interface

Use	Ethernet interface with PC or PLC
Data format	Modbus TCP/IP
Ethernet	The Ethernet interface operates at 10Mbit, half duplex

Warning: Connect the shield to the reference ground or shield pin of the power connector.
Warning: Disconnect xFace PC software for Ethernet interfacing.

Load Cell Connection

See chapter 4.2.2

Power Supply Connection

See chapter 4.2.1

9.3. Interfacing

FAD-30EN instruments have two interface connectors on the front of the instrument: Ethernet and RS-232C. The table below describes the data formats for interfacing the peripherals and their application:

Data Format	Description	Application	Hardware
Modbus TCP/IP	Ethernet interfacing. Refer to chapter 5.10	Interfacing with PLC	Ethernet

Table 9.2 – Data output interfacing

Attention: Please disable the interface you will not use to increase the performance of the instrument.

9.4. Setup and Calibration

FAD-30EN instruments are set up and calibrated by xFace. The A/D Converter settings are very important for a good weighing performance. Please refer to chapter 5.3.

9.5. Ethernet Setup

The Ethernet setup is done by xFace software as described in this chapter. Select the Gateway tab after connecting xFace to the instrument. You will see the Ethernet parameters in this tab.

Ethernet Setup

There are 11 setup parameters for the Ethernet network as described below:

Host Name	Device name of the instrument. Default is ‘ ’.
Data Format	This parameter defines the data format for the Ethernet port. The available settings are: Disable : No data will be transmitted. Select disable if this port is not used. Modbus-TCP/IP : Modbus TCP/IP communication. Refer to chapter 5.10 for details.
IP Address	Define IP address manually. Default is ‘192.168.16.250’
Local Port	Ethernet connection port of the instrument. Default is ‘10001.
Gateway	Network point that acts as an entrance to other networks. Default is ‘192.168.16.254’.
Subnet Mask	Defines IP addresses which can be used in network. Default is ‘255.255.255.0’.
Primary DNS	Define primary DNS manually. Default is ‘208.67.222.222’.
Secondary DNS	Define secondary DNS manually. Default is ‘208.67.220.220’.

Modbus Data Structure

If the instrument is set up for Modbus TCP/IP, it can be used as a Modbus TCP/IP slave on an Ethernet communication network. The function codes ‘0x03’ and ‘0x10’ are supported.
For the Modbus Data Structure please refer to chapter 5.10.

10. FAD-30CO – WITH CANOPEN INTERFACE

FAD-30CO instruments are state-of-the-art strain gauge load cell signal digitizers with CANopen interface. These instruments are used for any type of process weighing and force measurement including tank and silo weighing, dynamic weighing, check weighing, filling, tension /compression force measurement etc.
The EDS file is available on a CD which is supplied together with the instrument.

10.1. Front View

There are 5 status LEDs on the front panel which indicate the operational instrument status (Refer to table 10.1) and the CANopen status. The setup switch on front panel of the instrument is used for ProfiNet addressing without PC (Refer to chapter 5.6) and for diagnostics (Refer to chapter 12).
When the error LED is ON, the other two LED indicate the error type (Refer to chapter 11 for details).
Load cell connection, CANopen connection, power supply and serial interface terminals are located at the front of the DIN rail mount instrument (See figure 10.1).

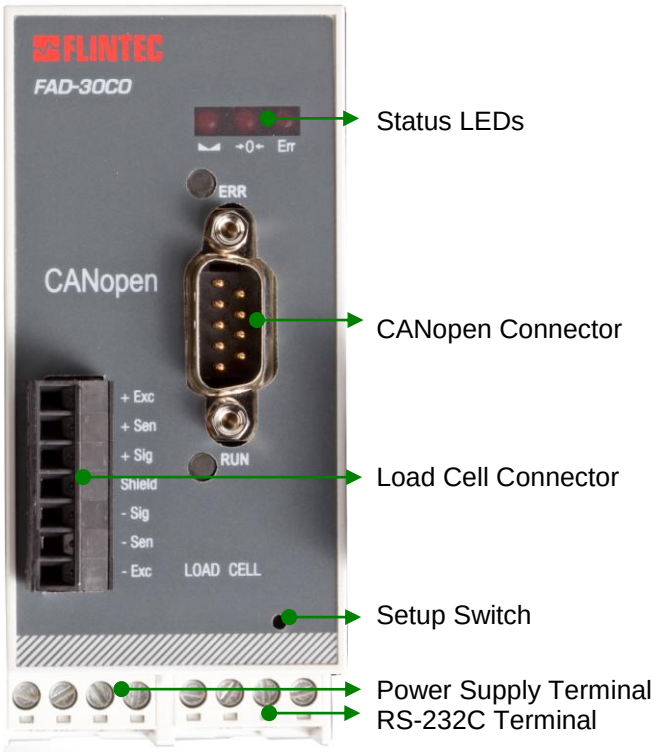


Figure 10.1 – Front view

The meanings of these LEDs in operation are described below.

LED		Operational Mode	
Symbol	Name	Weight / Force	Count
▂▃▂	Stable	● Stable ○ Unstable	◐ Off for 0.3 seconds in 2 seconds period (No stable indication)
→0←	Centre of Zero	● in the centre of zero range (-0.25 e < w < 0.25 e) ○ Out of centre of zero range	○ Always off (No centre of zero indication)
Err	Error (*)	● ADC conversion error ✹ Digital processing error ○ No error	● ADC conversion error ✹ Digital processing error ○ No error

○ Off ● On ✹ Flashing ◐ Off for 0.3 seconds

(*) : Refer to the error table in chapter 11.

Table 10.1 – Status LEDs

RUN LED

State	Indication	Comment
Off	No power or not initialized	No power or cable broken
Green	On-line, data exchange	
Green, flashing	On-line, initializing	
Green, single flash	Stopped	Check for hardware damages
Green, flickering	Auto baud rate detection in progress	
Red	Exception error	Check EDS file

ERR LED

State	Indication	Comment
Off	No error	No power or CANopen module is inizializing
Red, single flash	Warning limit reached	Bus error counter reached or exceeded its warning limit
Red, flickering	LSS	LSS services in progress
Red, double flash	Error count event	A guard (NMT slave or master) or heartbeat event has occured
Red	Bus off (fatal event)	Bus off

10.2. Electrical Connections

CANopen and RS-232C connections are shown in figure 10.2.

CANopen Connector (DB9M)

Pin	Signal	Description
1	-	-
2	CAN_L	-
3	CAN_GND	-
4	-	-
5	CAN_SHIELD	-
6	-	-
7	CAN_H	-
8	-	-
9	-	-
Housing	Cable shield	-

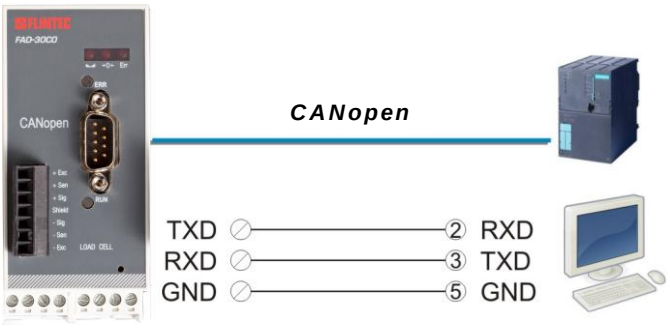


Figure 10.2 – FAD-30CO interface connections

RS-232C Serial Interface

Use	Setup via xFace
Baud rate	9600 bps
Length and parity	8 bit no parity
Start / Stop bits	1 start bit and 1stop bit

CANopen Interface

Use	Interfacing with PC or PLC
Data format	CANopen
Baud rate	Automatically detected and supported baud rates are 10 kbps, 20 kbps, 50 kbps, 100 kbps, 125 kbps, 250 kbps, 500 kbps, 800 kbps, 1 Mbps; Autobaud is default setting.

Warning: Connect the shield to the reference ground or shield pin of the power connector.
Warning: Disconnect xFace PC software for Profibus interfacing.

Load Cell Connection

See chapter 4.2.2

Power Supply Connection:

See chapter 4.2.1

10.3. Interfacing

FAD-30CO instruments have two interface connectors on the front of the instrument: CANopen and RS-232C. The table below describes the data formats for interfacing the peripherals and their application.

Data Format	Description	Application	Hardware
CANopen	CANopen interfacing. Refer to chapter 5.12	Interfacing with PLC	CANopen

Table 10.3 – Data output interfacing

Attention: Please disable the interface you will not use to increase the performance of the instrument.

10.4. Setup and Calibration

FAD-30CO instruments are set up and calibrated by xFace. The A/D Converter settings are very important for a good weighing performance. Please refer to chapter 5.3.

10.5. CANopen Setup

The CANopen setup is done by xFace software as described in this chapter. Select the Gateway tab after connecting xFace to the instrument. You will see the CANopen parameters in this tab.

CANopen Setup

There is only one parameter for the CANopen network.

CANopen Rack Address	The address range is 1 (default setting) to 127.

CANopen Data Structure

Please refer to chapter 5.12.

11. ERROR TABLE

The FAD-30 A/D Converters have been designed as very reliable and virtually error free instruments. However if an error occurs do not attempt to repair the equipment before you understand what caused the error. Note the problems you have with your instrument and the error messages shown by the LEDs located on the front panel. Then try to solve the problem according to the error table given below.

Error Code			Description	Actions to undertake / Possible cause
▁◢	→0←	Err		
○	○	●	ADC error	− Re-energize the instrument. − Instrument could be defective.
○	●	●	Overload	− Check the load. − Load cell or instrument could be defective.
●	○	●	Weight is too low	
●	●	●	ADC out	− Check the load. − Check the calibration. − Load cell or instrument could be defective.
○	○	✸	System error	− Re-energize the instrument. − Instrument could be defective.
●	○	✸	Board identity error	− Re-energize the instrument. − If seen again, repeat the setup of the instrument.
●	●	✸	Internal communication error	− Re-energize the instrument. − If seen again, change the cabling inside the housing.
○	✸	✸	High voltage detected	− Check the power supply, the voltage has to be within the required voltage range.
✸	○	✸	Low voltage detected	− Check the power supply, the voltage has to be within the required voltage range.

○ Off ● On ✸ Flash

Table 11.1 – Error table

12. DIAGNOSTICS

In this test menu serial interface tests (RC-232C and/or RS-485) and load cell signal analog to digital conversion and processing tests are performed sequentially.
For entering the diagnostics mode, press the setup switch before power on and release the switch after the instrument is powered on. The instrument will go into the RS-232C RXD test mode which is indicated by lighted ▂▁ LED and flashed Err LED as shown below. The status of LEDs on the front panel indicate the test steps and the test result as described below. You can go to the next test by pressing the setup switch.

Test	LED's Status			Description
	▂▁	→0←	Err	
RS-232C RxD	◐	○	✸	▂▁ LED gets off 0.3 s after receiving any data. Press the setup switch to go to the next test step.
RS-232C TxD	◐	✸	✸	'A' to 'Z' characters are sent sequentially in 0.8 s intervals. If the same data is received, ▂▁ LED gets off for 0.3 s. Press the setup switch to go to the next test step.
RS-485 RD (for FAD-30 and FAD-30MB only)	◐	○	○	▂▁ LED gets off for 0.3 s after receiving any data. Press the setup switch to go to the next step.
RS-485 TD (for FAD-30 and FAD-30MB only)	●	✸	○	'A' to 'Z' characters are sent sequentially in 0.8 s intervals. Press the setup switch to go to the next step.
Load cell signal	●	◐	●	→0← LED gets off while the load cell signal increases. Press the setup switch to go to the next step.
	◐	●	●	▂▁ LED gets off while the load cell signal decreases. Press the setup switch to return to the RS-232C RxD test.

○ Off ● On ✸ Flash ◐ Off for 0.3 second

Table 12.1 – Diagnostics

13. FREQUENTLY ASKED QUESTIONS

Question	:	My PC cannot communicate with the FAD-30 instrument. How can I check the COM port?
Answer	:	− Connect the instrument to the PC and run Hyper Terminal. − Check the COM ports as described in chapter 12.
Question	:	xFace installation needs to restart every time. How can I install it?
Answer	:	− Read and follow the installation notes in the installation directory. − Update your computer (visit http://update.microsoft.com).
Question	:	xFace cannot communicate with the FAD-30 instrument. What can I do?
Answer	:	− Check the power, data cabling and LED status of the FAD-30 instrument. − Check the PC port settings. − Remove other connections. – Re-energize the FAD-30 instrument and re-start the communication.
Question	:	My PC doesn't have any COM port. How can I connect it with the FAD-30 instrument?
Answer	:	You can use a RS-232 / USB converter for serial interfacing via USB port. Select the COM port within the Connection Settings menu.
Question	:	My PC has a COM port but I cannot see any COM port in the Connection Setting menu. How can I solve that problem?
Answer	:	Another software may be connected to that COM port. Close all applications before you start xFace.
Question	:	My PC cannot interface with FAD-30. How can I check the COM ports?
Answer	:	Short circuit the RXD and TXD pins of your COM port. Use any terminal software to check if the sent data will be received or not. You may also test the FAD-30 COM ports as described in chapter 12 by short circuiting the RXD and TXD terminals.
Question	:	I need very fast communication. What is the response delay time of FAD-30?
Answer	:	FAD-30 response delay is max. 4 ms for weight data.
Question	:	What is the external conversion rate of FAD-30?
Answer	:	Only the continuous data output rate may be described by external conversion rate. It depends on the baud rate and data length and can be up to 65 conversions/second.

Table 13.1 – FAQ